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ENGINEERING CHANGE NOTICE

Page 1 of 2

1. ECN 643811

Proj. ECN

2. ECN Category (mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.	4. USQ Required?	5. Date
Supplemental [] Direct Revision [X] Change ECN [] Temporary [] Standby [] Supersedure [] Cancel/Void []	Jim G. Field, Data Assessment and Interpretation, R2-12, 376-3756	[] Yes [X] No	07/29/98
	6. Project Title/No./Work Order No.	7. Bldg./Sys./Fac. No.	8. Approval Designator
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[] Yes (fill out Blk. 12b) [X] No (NA Blks. 12b, 12c, 12d)	N/A	N/A Design Authority/Cog. Engineer Signature & Date	N/A Design Authority/Cog. Engineer Signature & Date

13a. Description of Change — 13b. Design Baseline Document? [] Yes [X] No

The document has been totally revised to include the results of recent sampling to address technical issues associated with the waste, and to update the best basis standard inventory.

14a. Justification (mark one)

Criteria Change	[X]	Design Improvement	[]	Environmental	[]	Facility Deactivation	[]
As-Found	[]	Facilitate Const	[]	Const. Error/Omission	[]	Design Error/Omission	[]

14b. Justification Details

Changes required to incorporate new sampling data.

15. Distribution (include name, MSIN, and no. of copies)

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ECN-643811

16. Design Verification Required	17. Cost Impact				18. Schedule Impact (days)	
	ENGINEERING		CONSTRUCTION			
[] Yes	Additional	[] $	Additional	[] $	Improvement	[]
[X] No	Savings	[] $	Savings	[] $	Delay	[]

19. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 13. Enter the affected document number in Block 20.

SDD/DD	[]	Seismic/Stress Analysis	[]	Tank Calibration Manual	[]
Functional Design Criteria	[]	Stress/Design Report	[]	Health Physics Procedure	[]
Operating Specification	[]	Interface Control Drawing	[]	Spares Multiple Unit Listing	[]
Criticality Specification	[]	Calibration Procedure	[]	Test Procedures/Specification	[]
Conceptual Design Report	[]	Installation Procedure	[]	Component Index	[]
Equipment Spec.	[]	Maintenance Procedure	[]	ASME Coded Item	[]
Const. Spec.	[]	Engineering Procedure	[]	Human Factor Consideration	[]
Procurement Spec.	[]	Operating Instruction	[]	Computer Software	[]
Vendor Information	[]	Operating Procedure	[]	Electric Circuit Schedule	[]
OM Manual	[]	Operational Safety Requirement	[]	ICRS Procedure	[]
FSAR/SAR	[]	IEFD Drawing	[]	Process Control Manual/Plan	[]
Safety Equipment List	[]	Cell Arrangement Drawing	[]	Process Flow Chart	[]
Radiation Work Permit	[]	Essential Material Specification	[]	Purchase Requisition	[]
Environmental Impact Statement	[]	Fac. Proc. Samp. Schedule	[]	Tickler File	[]
Environmental Report	[]	Inspection Plan	[]		[]
Environmental Permit	[]	Inventory Adjustment Request	[]		[]

20. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number Revision
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21. Approvals

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Design Authority		Design Agent	
Cog. Eng. J.G. Field *J.G. Field*	7/31/98	PE	
Cog. Mgr. K.M. Hall *Kathleen M Hall*	7/31/98	QA	
QA		Safety	
Safety		Design	
Environ.		Environ.	
Other J.W. Cammann *JW Cammann*	8/31/98	Other	
R.J. Cash *R J Cash*	8/4/98	DEPARTMENT OF ENERGY	
For J.G. Kristofzski *[signature]*	8/5/98	Signature or a Control Number that tracks the Approval Signature	
		ADDITIONAL	

Tank Characterization Report for Double-Shell Tank 241-AW-103

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U.S. Department of Energy Contract DE-AC06-87RL10930

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Abstract: This document summarizes the information on the historical uses, present status, and the sampling and analysis results of waste stored in Tank 241-AW-103. This report supports the requirements of the Tri-Party Agreement Milestone M-44-15B.

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Tank Characterization Report for Single-Shell Tank 241-AW-103

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LIST OF TERMS

AES	atomic emission spectroscopy
Btu/hr	British thermal units per hour
Ci	curie
Ci/g	curies per gram
Ci/L	curies per liter
CI	confidence interval
cm	centimeter
CWZr2	zirconium cladding waste
DQO	data quality objective
DSC	differential scanning calorimetry
DSSF	double-shell slurry feed
ECN	Engineering Change Order
ft	feet
ft^2	square feet
g	gram
g/cm^3	grams per cubic centimeter
g/gal	grams per gallon
g/L	grams per liter
g/mL	grams per milliliter
HDW	Hanford defined waste
HTCE	historical tank content estimate
IC	ion chromatography
ICP	inductively coupled plasma spectroscopy
in.	inch
J/g	joules per gram
kg	kilogram
kg/L	kilograms per liter
kgal	kilogallon
kL	kiloliter
kW	kilowatt
L	liter
LFL	lower flammability limit
L/gal	liter per gallon
LL	lower limit
m	meter
m^2	square meters
M	moles per liter
mm	millimeter
n/a	not applicable

LIST OF TERMS (Continued)

NCRW	neutralized cladding removal waste
nCi/g	nanocuries per gram
n/r	not reported
PHMC	Project Hanford Management Contractor
PUREX	plutonium uranium extraction
ppm	parts per million
QC	quality control
REDOX	reduction-oxidation
RPD	relative percent difference
SAP	sampling and analysis plan
SMM	supernatant mixing model
TCR	tank characterization report
TGA	thermogravimetric analysis
TIC	total inorganic carbon
TLM	tank layer model
TOC	total organic carbon
TWRS	Tank Waste Remediation System
UL	upper limit
W	watt
WSTRS	Waste Status and Transaction Record Summary
wt%	weight percent
%	percent
°C	degrees Celsius
°F	degrees Fahrenheit
μCi/g	microcuries per gram
μCi/gal	microcuries per gallon
μCi/mL	microcuries per milliliter
μeq/g	micro equivalents per gram
μg	microgram
μg C/g	micrograms of carbon per gram
μg/g	micrograms per gram
μg/mL	micrograms per milliliter

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1.0 INTRODUCTION

A major function of the Tank Waste Remediation System (TWRS) is to characterize waste in support of waste management and disposal activities at the Hanford Site. Analytical data from sampling and analysis and other available information about a tank are compiled and maintained in a tank characterization report (TCR). This report and its appendices serve as the TCR for double-shell tank 241-AW-103. The objectives of this report are 1) to use characterization data in response to technical issues associated with tank 241-AW-103 waste, and 2) to provide a standard characterization of this waste in terms of a best-basis inventory estimate. Section 2.0 summarizes the response to technical issues, Section 3.0 shows the best-basis inventory estimate, Section 4.0 makes recommendations about the safety status of the tank and additional sampling needs. The appendices contain supporting data and information. This report supports the requirements of the *Hanford Federal Facility Agreement and Consent Order* (Ecology et. al. 1997), Milestone M-44-15b, change request M-47-97-03, to "issue characterization deliverables consistent with the Waste Information Requirements Documents developed for 1998."

1.1 SCOPE

The characterization information in this report originated from sample analyses and known historical sources. The results of recent sample events will be used to fulfill the requirements of the data quality objectives (DQOs) and memoranda of understanding specified in Brown et al. (1997) for this tank. Other information can be used to support conclusions derived from these results. Appendix A contains historical information for tank 241-AW-103 including surveillance information, records pertaining to waste transfers and tank operations, and expected tank contents derived from a process knowledge model. Appendix B summarizes recent sampling events (see Table 1-1), sample data obtained before 1989, and current sampling results. Appendix C reports the statistical analysis and numerical manipulation of data used in issue resolution. Appendix D contains the evaluation to establish the best basis for the inventory estimate and the statistical analysis performed for this evaluation. Appendix E is a bibliography that resulted from an in-depth literature search of all known information sources applicable to tank 241-AW-103 and its respective waste types. The reports listed in Appendix E are available in the Tank Characterization and Safety Resource Center.

Table 1-1. Summary of Recent and Historic Sampling.

Sample/Date[1]	Phase	Location	Segmentation	% Recovery
Push core (1/23/89)	Solid/liquid	Riser 16B	10 segments	83%
Grab (9/29/94)	Liquid	Riser 1A	n/a	n/a
Combustible gas test (5/1/97)	Gas	Dome	n/a	n/a
Push core (5/2/97)	Solid/liquid	Riser 10A	7 segments, divided into upper half and lower half	84%
Push core (5/2/97)	Solid/liquid	Riser 12A	7 segments, divided into upper half and lower half	95%

Notes:
[1]Dates are in the mm/dd/yy format.

1.2 TANK BACKGROUND

Tank 241-AW-103 went into service in the second half of 1980. It was filled with double-shell slurry feed (DSSF) and supernatant wastes. Double-shell slurry feed, produced during campaigns 80-10 and 81-1, was pumped to tanks 241-AW-101 and 241-AX-101 and allowed to settle. The resulting supernatant was pumped to tank 241-AW-103. During the second quarter of 1983, the tank began receiving neutralized cladding removal waste (NCRW). From 1983 through 1988 the tank received zirconium cladding waste (CWZr2) and flush water. In 1983, some waste was transferred to tanks 241-AW-105 and 241-AW-106. From 1984 through 1989, supernatant from NCRW was periodically decanted and concentrated in the 242-A Evaporator, leaving accumulated sludge in the tank. The tank received its final transfer of NCRW in 1988. The most recent addition to the tank was a small amount of waste from miscellaneous plutonium-uranium extraction (PUREX) waste streams in 1991. In 1994, waste was transferred from tank 241-AW-103 to tank 241-AP-107.

Table 1-2 summarizes the description of tank 241-AW-103. The tank has a maximum storage capacity of 4,391 kL (1,160 kgal) and, as of March 1998, contains an estimated 1,938 kL (512 kgal) of dilute noncomplexed waste (Hanlon 1998). The tank is not on the Watch List (Public Law 101-510).

Table 1-2. Description of Tank 241-AW-103.

TANK DESCRIPTION	
Type	Double-shell
Constructed	1978-1980
In service	1980
Diameter	22.9 m (75 ft)
Operating depth	10.7 m (35.2 ft)
Capacity	4,391 kL (1,160 kgal)
Bottom shape	Flat
Ventilation	Active
TANK STATUS	
Waste classification	Dilute noncomplexed/PUREX decladding
Total waste volume[1]	1,938 kL (512 kgal)
Supernatant volume	564 kL (149 kgal)
Saltcake volume	0 kL (0 kgal)
Sludge volume	1,374 kL (363 kgal)
Drainable interstitial liquid volume	140 kL (37 kgal)
Waste surface level (03/31/98)[2]	472 cm (186.5 in.)
Temperature (2/3/97 to 1/26/98)	12.8 °C (55 °F) to 20.0 °C (68 °F)
Integrity	Sound
Watch List	None
Flammable Gas Facility Group	2
SAMPLING DATE	
Gas grab sample	1994
Push mode core	May 1997
Combustible gas test	May 1997
SERVICE STATUS	
Active	

Notes:
[1]Waste volume is estimated from surface-level measurements.
[2]Dates are in the mm/dd/yy format.

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2.0 RESPONSE TO TECHNICAL ISSUES

Four technical issues have been identified for tank 241-AW-103 (Brown et al. 1997).

- **Safety screening**: Does the waste pose or contribute to any recognized potential safety problems?

- **Organic solvents**: Does an organic solvent pool exist that may cause a fire or ignition of organic solvents in entrained waste solids?

- **Pretreatment**: What fraction of the waste is soluble when treated by sludge washing and leaching?

- **Privatization**: Do the samples taken from tank 241-AW-103 and the subsequent laboratory analysis meet the needs of the privatization low-activity waste DQO (Jones and Wiemers 1996)?

- **Compatibility**: Will safety problems be created as a result of commingling waste in interim storage? Do operations issues exist which should be addressed before waste is transferred?

The sampling and analysis plan (SAP) (Benar 1997) provides the types of sampling and analysis used to address the above issues. Data from the analysis of push core samples and tank vapor space measurements, along with available historical information, provided the means to respond to the technical issues. Sections 2.1 and 2.2 present the response. See Appendix B for sample and analysis data for tank 241-AW-103.

2.1 SAFETY SCREENING

The data needed to screen the waste in tank 241-AW-103 for potential safety problems are documented in *Tank Safety Screening Data Quality Objective* (Dukelow et al. 1995). These potential safety problems are exothermic conditions in the waste, flammable gases in the waste and/or tank headspace, and criticality conditions in the waste. Each condition is addressed separately below.

2.1.1 Exothermic Conditions (Energetics)

The first requirement outlined in the safety screening DQO (Dukelow et al. 1995) is to ensure there are not sufficient exothermic constituents (organic or ferrocyanide) in tank 241-AW-103 to pose a safety hazard. Because of this requirement, the energetics in tank 241-AW-103 waste were evaluated. The safety screening DQO required the waste sample profile be tested for energetics every 24 cm (9.5 in.) to determine whether the energetics exceeded the safety threshold limit. The threshold limit for energetics is 480 J/g on a dry weight basis.

Differential scanning calorimetry (DSC) results indicated no exotherms were present in 50 of 58 primary/duplicate analyses when the 1997 core and 1994 grab samples were combined. Exotherms were present in 4 of 29 samples, that is, core 193, segments 4, 9, and 10; and core 194, segment 10, lower half. Two exotherms exceeded the limit, and three had 95 percent upper confidence limits that exceeded the limit. The inexplicably high exothermic values (approximately 970 J/g) in the primary/duplicate result for core 193, segment 4, lower half, were not reproduced on two subsequent reruns. Although some results were above threshold values, the average water content was approximately 55 percent; therefore, a propagating reaction is highly unlikely.

2.1.2 Flammable Gas

Headspace measurements were determined on May 1, 1997, before taking push core samples. Flammable gas was detected at 3.6 percent of the lower flammability limit (LFL). This is below the safety screening limit of 25 percent of the LFL.

2.1.3 Criticality

The safety screening DQO threshold for criticality, based on total alpha activity, is 1 g/L. Because total alpha activity is measured in μCi/mL instead of g/L, the 1 g/L limit is converted into units of μCi/mL by assuming that all alpha decay originates from ^{239}Pu. The safety threshold limit is 1 g ^{239}Pu per liter of waste. Assuming that all alpha is from ^{239}Pu for an average sample density of 1.49 g/mL, 1 g/L of ^{239}Pu is 41.6 μCi/g of alpha activity. The highest mean total alpha activity result was 1.1 μCi/g (core 193, segment 5, lower half) and the highest individual result (duplicate analysis of this sample) was 1.17 μCi/g. The maximum upper limit to a 95 percent confidence interval on the mean was 1.54 μCi/g (core 193, segment 5, lower half), indicating the potential for a criticality event is extremely low. Therefore, criticality is not a concern for this tank. Appendix C contains the method used to calculate confidence limits.

2.2 ORGANIC SOLVENTS SAFETY SCREENING

The data required to support the organic solvent screening issue are documented in the *Data Quality Objective to Support Resolution of the Organic Solvent Safety Issue* (Meacham et al. 1997). The DQO requires tank headspace samples be analyzed for total nonmethane organic compounds to determine whether the organic extractant pool in the tank is a hazard. The purpose of this assessment is to ensure that an organic solvent pool fire or ignition of organic solvents cannot occur. This issue is expected to be closed in fiscal year 1998.

No vapor samples have been collected from tank 241-AW-103 to estimate the organic pool size. However, the organic program has determined that even if an organic solvent pool does exist, the consequences of a fire or ignition of organic solvents is below risk evaluation guidelines for all of the tanks. Consequently, vapor samples are not required for this tank.

2.3 PRETREATMENT

Samples from the push-mode core sampling of tank 241-AW-103 were archived for future pretreatment analyses and evaluation in accordance with the *Strategy for Sampling Hanford Site Tanks for Development of Disposal Technology* (Kupfer et al. 1995).

2.4 PRIVATIZATION

Tank 241-AW-103 is within the scope of the privatization low-activity waste DQO (Jones and Wiemers 1996). The purpose of the low-activity waste DQO is to address technical issues pertinent to pretreatment, immobilization, and balance of plant for low-activity waste processing. Waste will be characterized to determine whether it falls within the defined process design envelope. Data collected in support of this DQO will be used primarily for planning activities of TWRS privatization contractors as specified in the privatization request for proposals. Samples have not been evaluated yet to satisfy this DQO.

2.5 COMPATIBILITY LIMITS

The analysis of waste compatibility samples was governed by the *Data Quality Objectives for the Waste Compatibility Program* (Carothers 1994). The DQO lists the analytes required to make safety and operations decisions about transferring waste. Table 2-1 shows the comparisons between the DQO-specified concentration limits of these critical analytes and the analytical results. All analytes met their respective criteria. Specific gravity results are biased low (a few percent) because of the gravimetric method used for highly radioactive samples. This is the reason for specific gravity values of less than one.

Table 2-1. Waste Compatibility Limits.

Decision	Analyte or Parameter and Associated Limit						
	Plutonium Equivalent[1]	Specific Gravity[2]	Exotherm/ Endotherm Ratio[3]	Nitrate[4]	Nitrite[4]	Hydroxide[4]	Analytical Result
Criticality	$\leq$0.05 g/gal	n/a					8.15E-07 g/gal
Flammable gas accumulation	n/a	<1.3	n/a				0.992
Energetics	n/a		<1	n/a			No exotherms observed
Corrosivity	n/a			$\leq$ 1.0M	0.011M $\leq[NO_2^-]$ $\leq$5.5M	0.01M $\leq[OH^-]$ $\leq$8.0M	NO_3^-: 0.06M NO_2^-: 0.02M OH^-: 0.15M

Notes:

[1]If the plutonium equivalent is $\leq$0.05 g/gal, allow the transfer. If it is >0.05 g/gal, resample and determine the mean of the new data. If it is $\leq$0.05 g/gal, allow the transfer. If it is >0.05 g/gal, do not allow the transfer.

[2]If the specific gravity is <1.3, allow the transfer or determine the weighted mean of the commingled waste. If the weighted mean specific gravity is $\leq$1.41, allow the transfer. If the weighted mean is >1.41, perform a detailed technical evaluation of the potential for gas accumulation in the commingled waste.

[3]If the source waste has no separable organic layer, and the source and the receiving waste have exotherm/endotherm ratios of <1, allow the transfer. Otherwise, perform a detailed evaluation of the waste exhibiting the reactive behavior.

[4]If all analytes meet the criteria, allow the transfer. Otherwise, mitigate by additions to the source.

2.6 OTHER TECHNICAL ISSUES

A factor in assessing tank safety is the heat generation and temperature of the waste. Heat is generated in the tanks from radioactive decay. Heat load calculations based on the 1997 sample event were not possible because radionuclide analyses were not conducted. An estimate of the tank heat load based on the tank headspace temperature (Kummerer 1995) was 85 W (290 Btu/hr); the Hanford defined waste (HDW) model estimated a heat load of 123 W (421 Btu/hr). These estimates are well below the limit of 20,500 W (70,000 Btu/hr) prescribed for the AW tanks. This limit is documented in HNF-IP-1266, *Tank Farms Operations Administrative Controls Manual* (Cox 1997).

2.7 SUMMARY

This section summarizes the results of sampling and analysis issues that apply to tank 214-AW-103. The sampling performed on the tank has met the needs of the applicable data quality objectives. The results of all analyses performed to address potential safety issues showed that primary analytes did not exceed safety decision threshold limits except for some DSC samples. Table 2-2 summarizes the characterization results for safety screening, organic solvent, and privatization issues.

Table 2-2. Summary of Technical Issues. (2 sheets)

Issue	Sub-issue	Result
Safety screening	Energetics	Exotherms were present in samples of the primary/duplicate samples of core 193, segment 4, lower half; segment 9, lower half; segment 10, lower half; and core 194, segment 10, lower half. Two samples exceeded the 480 J/g limit. The water content was 55%.
	Flammable gas	3.6% of the LFL
	Criticality	All total alpha analyses were well below the threshold limit of 41.6 μCi/g.
Organic solvents safety[1]	Solvent pool size	Tank 241-AW-103 was not vapor sampled because it is a double-shell tank.
Compatibility	Waste compatibility assessment	All analytes met waste capatibility criteria.

Table 2-2. Summary of Technical Issues. (2 sheets)

Issue	Sub-issue	Result
Pretreatment	Analysis for treatment to separate low-level and high-level waste streams	Samples were archived for future analysis.
Privatization	Low-activity waste	Samples have not yet been evaluated for this DQO.

Note:

[1]This issue is expected to be closed in fiscal year 1998.

3.0 BEST-BASIS INVENTORY

Information about chemical, radiological, and/or physical properties is used to perform safety analyses, engineering evaluations, and risk assessment associated with waste management activities, as well as regulatory issues. These activities include overseeing tank farm operations and identifying, monitoring, and resolving safety issues associated with these operations and with tank wastes. Disposal activities involve designing equipment, processes, and facilities for retrieving wastes and processing them into a form that is suitable for long-term storage.

Chemical and radiological inventory information are generally derived using the following three approaches: 1) component inventories are estimated using the results of sample analyses; 2) component inventories are predicted using the HDW model (Agnew et al. 1997) based on process knowledge and historical information; or 3) a tank-specific process estimate is made based on process flowsheets, reactor fuel data, essential material usage, and other operating data.

An effort is underway to provide waste inventory estimates that will serve as standard characterization source terms for various waste management activities (Hodgson and LeClair 1996). As part of this effort, an evaluation of chemical information for tank 241-AW-103 was performed. Data before 1994 is not presented because transfers to the tank have been made prior to that time. This report includes the following information:

- Data from samples from tank 241-AW-103 collected in 1997
- Supernatant data from grab samples collected in 1994
- Flow sheet information for the NCRW waste (Kupfer et al. 1997)
- Inventory estimates generated by the HDW model.

Except for sodium, all cations were assumed to be in their most common hydroxide or oxide form, and the concentrations of the assumed species were calculated stoichiometrically. Because precipitates are neutral species, all positive charge was attributed to the sodium cation. The anions were assumed to be present as sodium salts and were expected to balance the positive charge exhibited by the cations. Phosphate and sulfate, as determined by ion chromatography (IC), are assumed to be completely water soluble and appear only in the anion mass and charge calculations.

Best-basis tank inventory values are derived for 46 key radionuclides (as defined in Section 3.1 of Kupfer et al. 1997), all decayed to a common report date of January 1, 1994. Often waste sample analyses have only reported ^{90}Sr, ^{137}Cs, $^{239/240}Pu$, and total uranium (or total beta and total alpha), while other key radionuclides such as ^{60}Co, ^{99}Tc, ^{129}I, ^{154}Eu, ^{155}Eu, and ^{241}Am

have been infrequently reported. For this reason, it has been necessary to derive most of the 46 key radionuclides by computer models. These models estimate radionuclide activity in batches of reactor fuel, account for the split of radionuclides to various separations plant waste streams, and track their movement with tank waste transactions. (These computer models are described in Kupfer et al. 1997, Section 6.1, and in Watrous and Wootan 1997.) Model-generated values for radionuclides in any of 177 tanks are reported in Agnew et al. (1997). The best-basis value for any one analyte may be either a model result or a sample or engineering assessment-based result, if available. For a discussion of typical error between model-derived values and sample-derived values, see Kupfer et al. (1997), Section 6.1.10.

Table 3-1 and 3-2 show the best-basis inventory estimates for tank. The reported inventory values are subject to change. Refer to the Tank Characterization Database for current inventory values.

Table 3-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-AW-103 (Effective March 31, 1998). (2 sheets)

Analyte	Total Inventory (kg)	Basis (S, M, E, or C)[1]	Comment
Al	12,700	S/E	1989 sludge, 1997 supernatant data
Bi	772	S/E	1989 data, sludge only
Ca	1,800	S/E	1989 data, sludge only
Cl	1,840	S	
TIC as CO_3	17,300	S	
Cr	3,180	S/E	1989 sludge, 1997 supernatant data
F	124,000	S	
Fe	1,650	S/E	1989 data, sludge only
Hg	0	E	Simpson (1998)
K	31,000	S/E	1989 sludge, 1997 supernatant data
La	1,720	S/E	1989 data, sludge only
Mn	540	S/E	1989 data, sludge only
Na	2.97E+05	S	
Ni	358	S/E	1989 data, sludge only
NO_2	29,900	S	
NO_3	86,100	S	
OH_{TOTAL}	2.86E+05	C	Based on charge balance
Pb	3,610	S	Upper limit
PO_4	5,810	S/E	1989 ICP sludge, 1994 supernatant data

Table 3-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-AW-103 (Effective March 31, 1998). (2 sheets)

Analyte	Total Inventory (kg)	Basis (S, M, E, or C)[1]	Comment
Si	5,830	S	
SO_4	3,980	S	
Sr	361	E	Upper limit
TOC	10,900	S	
U_{TOTAL}	65,300	S	
Zr	2.21E+05	S	

Notes:

[1]S = sample-based, M = HDW model-based (Agnew et al. 1997), E = engineering assessment-based, and C = calculated by charge balance; includes oxides as hydroxides, not including CO_3, NO_2, NO_3, PO_4, SO_4, and SiO_3.

Table 3-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-AW-103 Decayed to January 1, 1994. (Effective March 31, 1998) (3 sheets)

Analyte	Total inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{3}H	41.3	M	
^{14}C	0.532	M	
^{59}Ni	0.196	M	
^{60}Co	7.84	M	
^{63}Ni	22.7	M	
^{79}Se	0.0665	M	
^{90}Sr	19,000	S	1989 sludge, 1994 supernatant data
^{90}Y	19,000	S	Based on ^{90}Sr activity
^{93}Zr	0.321	M	
^{93m}Nb	0.140	M	
^{99}Tc	2.31	M	
^{106}Ru	743	S	1989 data, sludge only
^{113m}Cd	3.37	M	

Table 3-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-AW-103 Decayed to January 1, 1994. (Effective March 31, 1998) (3 sheets)

Analyte	Total inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{125}Sb	189	M	
^{126}Sn	0.105	M	
^{129}I	0.00462	M	
^{134}Cs	83.9	M	
^{137}Cs	1.51E+05	S	1989 sludge, 1994 supernatant data
^{137m}Ba	1.43E+05	S	Based on 0.946 of ^{137}Cs activity
^{151}Sm	230	M	
^{152}Eu	1.53	M	
^{154}Eu	58.9	M	
^{155}Eu	277	M	
^{226}Ra	6.53E-07	M	
^{227}Ac	3.88E-06	M	
^{228}Ra	3.32E-04	M	
^{229}Th	7.73E-06	M	
^{231}Pa	2.07E-05	M	
^{232}Th	2.81E-05	M	
^{232}U	0.0133	S/E	Based on ICP U Sample result ratioed to HDW estimates for U isotopes.
^{233}U	0.0240	S/E	Based on ICP U Sample result ratioed to HDW estimates for U isotopes.
^{234}U	31.7	S/E	Based on ICP U Sample result ratioed to HDW estimates for U isotopes.
^{235}U	1.20	S/E	Based on ICP U Sample result ratioed to HDW estimates for U isotopes.
^{236}U	2.61	S/E	Based on ICP U Sample result ratioed to HDW estimates for U isotopes.
^{237}Np	0.0317	M	
^{238}Pu	61.6	S/M	Based on total alpha sample result ratioed to HDW estimates for Pu and Am
^{238}U	21.8	S/E	Based on ICP U Sample result ratioed to HDW estimates for U isotopes.

Table 3-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-AW-103 Decayed to January 1, 1994. (Effective March 31, 1998) (3 sheets)

Analyte	Total inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{239}Pu	499	S/M	Based on total alpha sample result ratioed to HDW estimates for Pu and Am
^{240}Pu	152	S/M	Based on total alpha sample result ratioed to HDW estimates for Pu and Am
^{241}Am	14.4	S/M	Based on total alpha sample result ratioed to HDW estimates for Pu and Am
^{241}Pu	6,290	S/M	Based on total alpha sample result ratioed to HDW estimates for Pu and Am
^{242}Cm	0.0497	S/M	Based on total alpha sample result ratioed to HDW estimates for Pu and Am
^{242}Pu	0.0235	S/M	Based on total alpha sample result ratioed to HDW estimates for Pu and Am
^{243}Am	0.00304	S/M	Based on total alpha sample result ratioed to HDW estimates for Pu and Am
^{243}Cm	0.00832	S/M	Based on total alpha sample result ratioed to HDW estimates for Pu and Am
^{244}Cm	0.0553	S/M	Based on total alpha sample result ratioed to HDW estimates for Pu and Am

Note:

[1]S = sample-based (see Appendix B), M = HDW model-based, Agnew et al. (1997), and E = engineering assessment-based.

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4.0 RECOMMENDATIONS

The sampling performed on the tank has met the needs of the applicable DQOs. The results of the safety screening data indicated that exotherms exceeding the 480 J/g (dry weight basis) limit were present in some samples. The mean water content for the solids/sludge was 55 percent, which would mitigate an exothermic reaction. Flammable gas was sampled before obtaining tank waste core samples and was determined to be 3.6 percent of the LFL. As for the criticality issue, all total alpha analyses were less than 1.2 μCi/g and well below the threshold value of 41.6 μCi/g.

No vapor samples were obtained in support of the organic solvent vapor screening DQO (Meacham et al. 1997). However, the TWRS Project Hanford Management Contractor (PHMC) program office has determined that additional vapor samples are not required for this tank, and the organic solvents issue is expected to be closed for all tanks in fiscal year 1998.

Samples have not been evaluated yet for the DQO concerning privatization. Privatization samples for this tank have not been requested as of March 30, 1998.

Table 4-1 summarizes the TWRS PHMC program review status and acceptance of the sampling and analysis results reported in this TCR. All issues required to be addressed by sampling and analysis are listed in column 1 of Table 4-1. Column 2 indicates by "yes" or "no" whether issue requirements were met by the sampling and analysis performed. Column 3 indicates concurrence and acceptance by the program in PHMC/TWRS that is responsible for the applicable issue. A "yes" in column 3 indicates no additional sampling or analyses are needed. Conversely, "no" indicates additional sampling or analysis may be needed to satisfy issue requirements.

Table 4-1. Acceptance of Tank 241-AW-103 Sampling and Analysis.

Issue	Sampling and Analysis Performed	Program[1] Acceptance
Safety screening data quality objective	Yes	Yes
Organic solvents safety data quality objective[2]	No	NA
Pretreatment data quality objective	Yes	NA
Privatization data quality objective[3]	No	No
Compatibility data quality objective	Yes	Yes

Notes:

[1]PHMC TWRS Program Office

[2]The organic solvent safety issue is expected to be closed for all tanks in fiscal year 1998.

[3]No samples from the privatization tank have been requested.

Table 4-2 summarizes the status of PHMC TWRS program review and acceptance of the evaluations and other characterization information contained in this report. Column 1 lists the evaluations performed in this report. Column 2 shows whether issue evaluations have been completed or are in progress. Column 3 indicates concurrence and acceptance with the evaluation by the program in PHMC/TWRS that is responsible for the applicable issue. A "yes" indicates that the evaluation is completed and meets all issue requirements. A "no" indicates that analysis has not yet been performed and that the issue is not yet closed.

Table 4-2. Acceptance of Evaluation of Characterization Data and Information for Tank 241-AW-103.

Issue	Evaluation Performed	TWRS[1] Program Acceptance
Safety screening data quality objective	Yes	Yes
Organic solvents data quality objective[2]	Yes	Yes
Pretreatment data quality objective	Yes	Yes
Privatization data quality objective	No	No
Waste compatibility data quality objective	Yes	Yes

Notes:

[1]PHMC TWRS Program Office

[2]The organic solvents safety issue is expected to be closed in fiscal year 1998. The PHMC TWRS safety program has determined that additional sampling is not required to close this issue for this tank.

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APPENDIX A

HISTORICAL TANK INFORMATION

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APPENDIX A

HISTORICAL TANK INFORMATION

Appendix A describes tank 241-AW-103 based on historical information. For this report, historical information includes information about the fill history, waste types, surveillance, or modeling data about the tank. This information is necessary for providing a balanced assessment of sampling and analytical results.

This appendix contains the following information:

- **Section A1.0**: Current tank status, including the current waste levels and the tank stabilization and isolation status
- **Section A2.0**: Information about the tank design
- **Section A3.0**: Process knowledge about the tank, the waste transfer history, and the estimated contents of the tank based on modeling data
- **Section A4.0**: Surveillance data for tank 241-AW-103, including surface-level readings, temperatures, and a description of the waste surface based on photographs
- **Section A5.0**: Appendix A references.

A1.0 CURRENT TANK STATUS

As of March 31, 1998, tank 241-AW-103 contained 1,938 kL (512 kgal) of dilute noncomplexed and PUREX decladding wastes (Hanlon 1998). This includes 564 kL (149 kgal) of supernatant liquid and 1,374 kL (363 kgal) of sludge. The volumes were last updated on March 31, 1998. This sludge volume estimate was used to calculate analyte concentrations and inventory projections associated with the sludge. Tank 241-AW-103 is in service, and the tank integrity is classified as sound. No unreviewed safety questions exist for tank 241-AW-103, and it is not on the Watch List.

Tank 241-AW-103 is equipped with a manual tape and an automated liquid indicator device to monitor the waste-surface level; both are operable (Hanlon 1998). As of March 31, 1998, the waste depth is approximately 472 cm (186 in.). All monitoring systems are currently in compliance with established standards (Hanlon 1998). From 1989 to the present, the tank's internal temperature was in the range 12.8 °C (55 °F) to 36 °C (97 °F). Active ventilation keeps tank contents cool and minimizes the potential for release of airborne contaminants to the environment.

Table A1-1. Tank 241-AW-103 Contents Status Summary.

Waste Type	kL (kgal)
Total waste	1,938 (512)
Supernatant[1]	564 (149)
Sludge	1,374 (363)
Saltcake	0 (0)
Drainable interstitial liquid	140 (37)
Drainable liquid remaining	704 (186)
Pumpable liquid remaining	621 (164)

Note:
[1]Hanlon (1998)

A2.0 TANK DESIGN AND BACKGROUND

Tank 241-AW-103 is one of six underground double-shell tanks that comprise the AW Tank Farm. Construction of this tank was completed in 1980 (Anderson 1990). The tank consists of a heat-treated (stress-relieved) primary steel liner inside a secondary liner; both liners are encased in a reinforced-concrete shell and covered by a reinforced-concrete dome. The tank has a diameter of 22.9 m or 75 ft and a depth of about 11 m (35 ft) for a maximum storage capacity of 4,390 kL (1,160 kgal) and an operating limit of 4,320 kL (1,140 kgal) (Hanlon 1998).

According to drawings and engineering change notices, tank 241-AW-103 has 23 risers. The risers range from 4 in. to 42 in. in diameter. Table A2-1 shows numbers, diameters, and descriptions of the risers and nozzles. Figure A2-1 shows the riser configuration for tank 241-AW-103 (Agnew et al. 1993). Figure A2-2 is a tank cross section showing the approximate waste level and a schematic of the tank equipment.

Table A2-1. Tank 241-AW-103 Risers.[1,2,3] (2 sheets)

New Riser	Old Riser	Diameter (in.)	Description and Comments
201	R1A	4	Liquid-level indicator (manual)
202	R1B	4	Sludge measurement port/spare
203[4]	R1C	4	Sludge measurement port/spare, P/CP[5] (12 in. cover)
204	R2A	4	Tank-level indicator (ENRAF[1] ECN-624982 11/15/95[6])
205	R3A	12	Supernatant pump
206	R4A	4	Thermocouple tree
207	R5A	42	Man hole/spare
208	R5B	42	Man hole/spare
211[4]	R7A	12	Spare (tank air inlet controller ECN-624519 2-27-96)
212	R7B	12	Vent (tank air inlet controller ECN-624519 2-27-96)
227[4]	R10A	4	Spare
228	R11A	42	Slurry distributor
229[4]	R12A	12	Observation port/spare
231	R13A	4	Liquid observation well
232	R13B	4	Tank pressure, P/CP[5] (24 in. cover)
233	R14A	4	Central pump pit dropleg nozzle supernatant return
234[4]	R15A	4	Spare
235	R16A	4	Sludge measurement port/spare
236	R16B	4	Tank pressure indicator (Tank pressure indicator/vapor spare sampler ECN-629545 02/29/96)
237[4]	R16C	4	Sludge measurement port/spare, P/CP[5] (12 in. cover)

[1]ENRAF is a trademark of ENRAF Corporation, Houston, Texas.

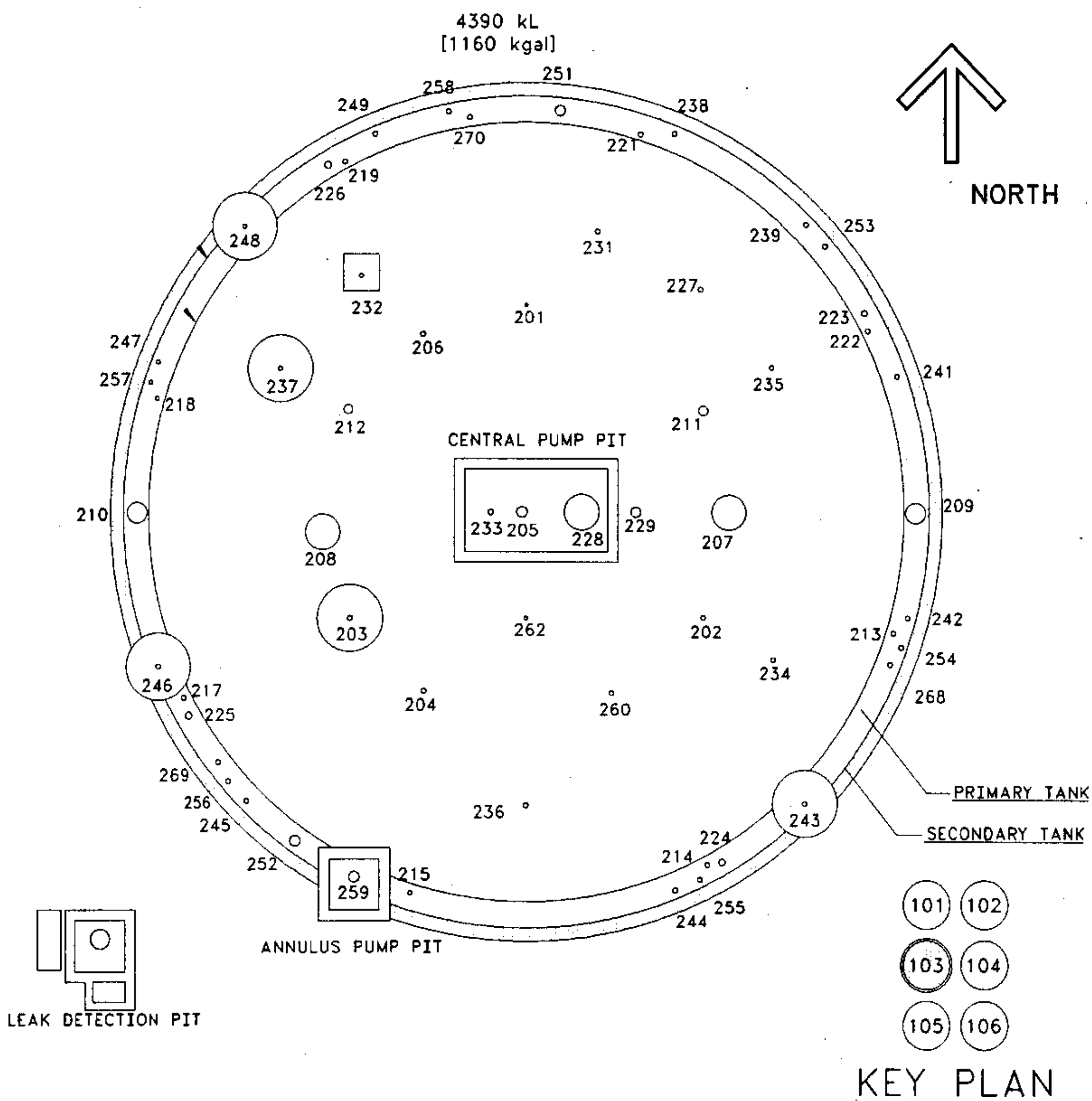
Table A2-1. Tank 241-AW-103 Risers.[1,2,3] (2 sheets)

New Riser	Old Riser	Diameter (in.)	Description and Comments
260	R21A	4	High-level sensor
262	R22A	4	Sludge measurement port
263	R24A	12	Spare

Notes:

[1]Tardiff (1997)
[2]Tran (1993)
[3]LMHC (1996)
[4]Denotes risers tentatively available for sampling (Lipnicki 1997)
[5]P/CP designates that a riser is recessed below a cement pad with an access plate at grade.
[6]Dates are provided in the mm/dd/yy format.

Figure A2-1. Riser Configuration for Tank 241-AW-103.



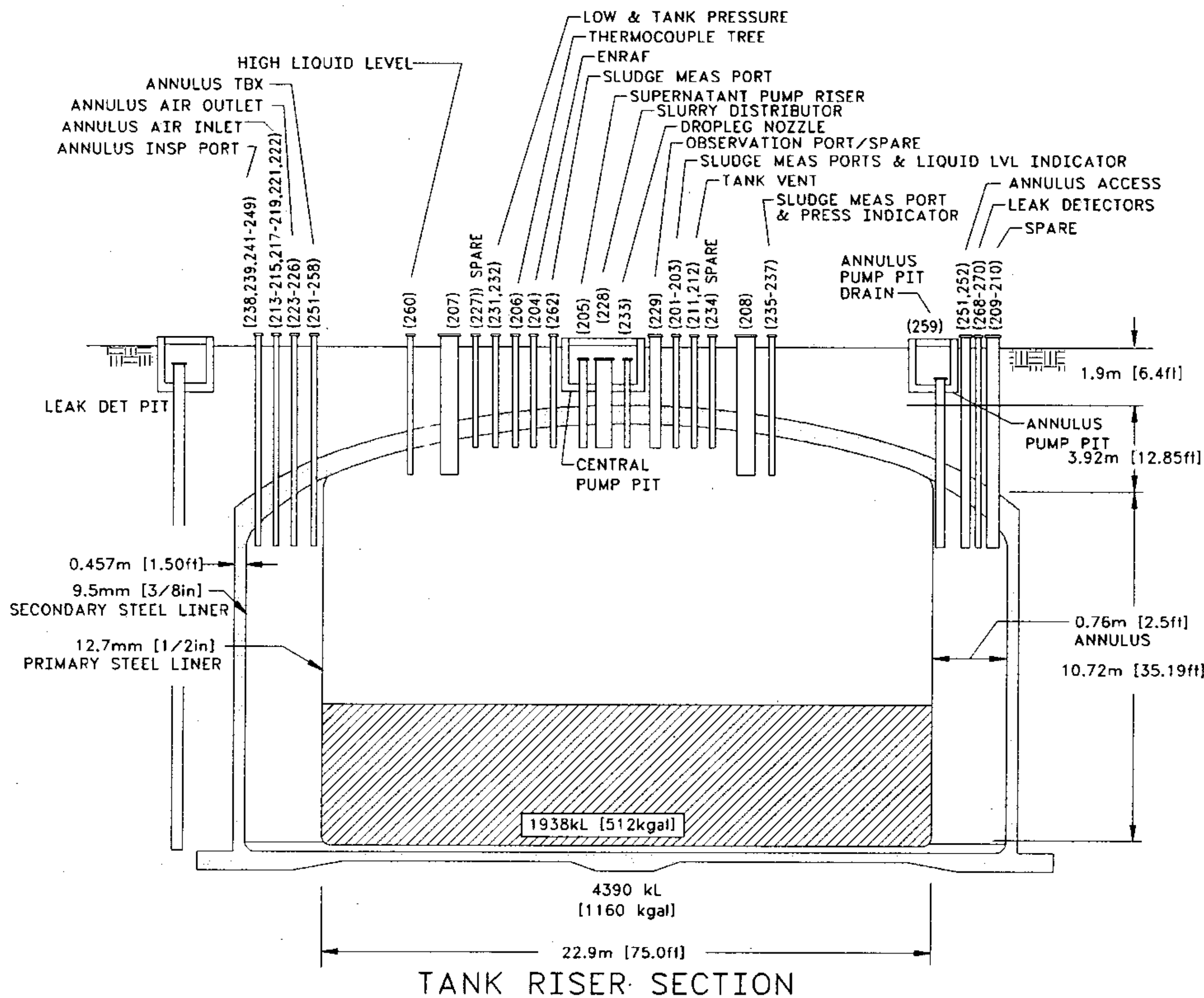


Figure A2-2. Tank 241-AW-103 Cross Section and Schematic.

Tanks in the 241-AW Tank Farm were designed to store 242-A Evaporator feed and slurry. Tank 241-AW-103 initially stored double-shell slurry feed and double-shell slurry feed supernatant. For most of its operational life, however, the tank has been used as a settling tank for PUREX NCRW.

A3.0 PROCESS KNOWLEDGE

The sections below 1) provide information about the transfer history of tank 241-AW-103, 2) describe the process wastes that made up the transfers, and 3) estimate the current tank contents based on transfer history.

A3.1 WASTE TRANSFER HISTORY

Table A3-1 summarizes the waste transfer history of tank 241-AW-103 based on Agnew et al. (1997b) from startup to the fourth quarter of 1989 and on the Hanford tank transfer database from 1990 to March 1998. Waste was initially added to tank 241-AW-103 after construction was completed in 1980.

Tank 241-AW-103 was put in service in 1980 and received its first waste transfer of 10 kgal (38 kL) of dilute caustic solution during the third quarter of 1980. During the fourth quarter of 1980, supernatant was transferred from tanks 241-A-101 and 241-AX-101 to tank 241-AW-103 and from tank 241-AW-103 to tank 241-AW-102. During the second quarter of 1982, tank 241-AW-103 received flush water and dilute, noncomplexed waste from 100 N.

From the first quarter of 1983, supernatant was transferred from tank 241-AW-103 to tanks 241-AW-102, 241-AW-106, and 241-AW-105. During this time, the tank received reduction-oxidation (REDOX) CWZr2 from PUREX and flush waste from miscellaneous sources. In the first quarter of 1991, the tank received noncomplexed waste from PUREX and flush water from miscellaneous sources. In 1994, the last transfer of waste, dilute noncomplexed waste, was sent to tank 241-AP-107.

Because Table A3-1 lists major transfers only for tank 241-AW-103, the sum of the transfers does not equal zero.

Table A3-1. Tank 241-AW-103 Major Transfers.[1]

Transfer Source	Transfer Destination	Waste Type	Time Period	Estimated Waste Volume kL (kgal)
241-A-101		Dilute caustic solution	1980	38 (10)
241-A-101 241-AX-101		Supernatant	1980	3,888 (1027)
	241-AW-102	Supernatant	1980	231 (61)
Miscellaneous sources		Water	1982	64 (17)
100N		$NRSO_4$	1982	549 (145)
	241-AW-102 241-AW-105 241-AW-106	Supernatant	1983-1989	16,788 (4,435)
PUREX		CWZr2 (REDOX)	1983-1988	13,109 (3,463)
Miscellaneous sources		Water	1983-1988	1,760 (465)
241-AW-102		Supernatant	1985	208 (55)
Unknown		Unknown	1988	72 (19)
Miscellaneous sources		Water	1991	4 (1)
PUREX		PUREX low-level waste	1991	38 (10)
	241-AP-107	Dilute noncomplexed waste[2]	1994	500 (132)

Notes:
[1]Agnew et al. (1997b)
[2]Defined as a waste with total organic carbon <1 weight percent

A3.2 HISTORICAL ESTIMATION OF TANK CONTENTS

The historical transfer data used for this estimate are from the following sources:

- The *Waste Status and Transaction Record Summary: WSTRS, Rev. 4*, (Agnew et al. 1997b) is a tank-by-tank quarterly summary spreadsheet of waste transactions.

- The *Hanford Tank Chemical and Radionuclide Inventories: HDW Model Rev. 4* (Agnew et al. 1997a) contains the HDW list, the supernatant mixing model (SMM), the tank layer model (TLM), and the historical tank content estimate (HTCE).

- The HDW list is comprised of approximately 50 waste types defined by concentration for major analytes/compounds for sludge and supernatant layers.

- The TLM defines the sludge and saltcake layers in each tank using waste composition and waste transfer information.

- The SMM is a subroutine within the HDW model that calculates the volume and composition of certain supernatant blends and concentrates.

Using these records, the HDW list and TLM define the sludge and saltcake layers in each tank. The SMM uses information from the WSTRS, the TLM, and the HDW list to describe the supernatants and concentrates in each tank. Together the WSTRS, TLM, SMM, and HDW list determine the inventory estimate for each tank. These model predictions are considered estimates that require further evaluation using analytical data. The model did not include the transfer of 500 kL (132 kgal) of waste to tank 241-AP-107 in 1994.

Based on Agnew et al. (1997a), tank 241-AW-103 contains 568 kL (283 kgal) of supernatant waste and 1,374 kL (363 kgal) of CWZr2. The HDW model differs from the measured volume of 1,938 kL (512 kgal) by 507 kL (134 kgal). The difference is probably caused by evaporative loss. Because a transfer has occurred since the model was developed, the TLM and historical tank inventory estimates may not represent current tank contents. However, the chemical compositon of the CWZr2 layer should still be the same.

The CWZr2 layer should contain the following constituents from highest concentration above one weight percent: sodium, fluoride, hydroxide, zirconium oxide, nitrate, and iron. The layer also should contain the following constituents above a tenth of a weight percent: calcium, carbonate, ammonia, and uranium. Table A3-2 shows an estimate of the expected concentrations of analytes and radionuclides in the waste.

Table A3-2. Historical Tank Inventory Estimate.[1, 2] (4 sheets)

Total Inventory Estimate					
Physical Properties				**-95 CI**	**+95 CI**
Total waste	2.86E+06 kg[3]	(646 kgal)			
Heat load	0.123 kW	421 Btu/hr		3.34E-03	0.244
Bulk density[4]	1.17 g/cm^3			1.00	1.20
Water wt%[4]	75.5			70.0	99.8
TOC wt% C (wet)[4]	1.17E-03			7.83E-04	1.56E-03
Constituents	***M***	**ppm**	**kg[5]**	**-95 CI**	**+95 CI**
Na^+	3.27	6.43E+04	1.84E+05	2.84E-02	4.12
Al^{3+}	6.06E-04	14.0	40.0	5.40E-04	6.73E-04
Fe^{3+}	0.205	9.79E+03	2.80E+04	5.46E-04	0.210
Cr^{3+}	1.64E-04	7.30	20.9	9.00E-05	2.39E-04
Bi^{3+}	4.34E-07	7.75E-02	0.222	4.15E-07	4.53E-07
La^{3+}	3.78E-09	4.49E-04	1.28E-03	2.79E-09	4.77E-09
Hg^{2+}	1.18E-03	203	580	2.93E-06	1.21E-03
Zr	0.522	4.07E+04	1.16E+05	1.28E-03	0.530
Pb^{2+}	1.20E-06	0.213	0.609	7.98E-07	1.61E-06
Ni^{2+}	3.13E-05	1.57	4.50	2.84E-05	3.42E-05
Sr^{2+}	0	0	0	0	0
Mn^{4+}	9.74E-05	4.57	13.1	4.17E-05	1.45E-04
Ca^{2+}	5.66E-02	1.94E+03	5.54E+03	3.87E-04	8.05E-02
K^+	0.184	6.15E+03	1.76E+04	2.95E-03	0.367
OH^-	2.91	4.23E+04	1.21E+05	1.23E-02	3.08
NO_3^-	0.326	1.73E+04	4.94E+04	1.08E-02	0.639
NO_2^-	9.15E-03	360	1.03E+03	9.66E-04	2.22E-02
CO_3^{2-}	5.84E-02	3.00E+03	8.57E+03	2.24E-03	8.23E-02
PO_4^{3-}	1.15E-03	93.2	267	5.03E-04	1.80E-03
SO_4^{2-}	1.57E-04	12.8	36.8	1.19E-04	1.94E-04
Si	3.08E-05	0.741	2.12	2.47E-05	3.67E-05
F^-	3.05	4.96E+04	1.42E+05	9.84E-03	3.69
Cl^-	3.98E-03	121	345	2.11E-04	7.79E-03

Table A3-2. Historical Tank Inventory Estimate.[1, 2] (4 sheets)

Total Inventory Estimate					
Constituents (Cont'd)	***M***	**ppm**	**kg[5]**	**-95 CI**	**+95 CI**
$C_6H_5O_7^{3-}$	1.31E-05	2.12	6.07	1.01E-05	1.61E-05
$EDTA^{4-}$	5.33E-06	1.31	3.76	2.14E-06	8.58E-06
$HEDTA^{3-}$	8.59E-06	2.01	5.76	2.21E-06	1.51E-05
$Glycolate^{-}$	8.43E-05	5.41	15.5	4.42E-05	1.25E-04
$Acetate^{-}$	6.61E-06	0.334	0.954	5.78E-06	7.90E-06
$Oxalate^{2-}$	4.95E-09	3.72E-04	1.07E-03	4.41E-09	5.49E-09
DBP	6.20E-05	11.1	31.8	3.03E-05	9.37E-05
Butanol	6.20E-05	3.92	11.2	3.03E-05	9.37E-05
NH_3	0.635	9.22E+03	2.64E+04	9.84E-03	1.25
$Fe(CN)_6^{4-}$	0	0	0	0	0
Radiological Constituents	**Ci/L**	**μCi/g**	**Ci[6]**	**-95 CI (Ci/L)**	**+95 CI (Ci/L)**
^{3}H	1.69E-05	1.44E-02	41.3	3.31E-07	3.36E-05
^{14}C	2.18E-07	1.86E-04	0.532	1.38E-08	4.24E-07
^{59}Ni	8.03E-08	6.86E-05	0.196	8.00E-08	8.03E-08
^{63}Ni	9.27E-06	7.93E-03	22.7	9.25E-06	9.28E-06
^{60}Co	3.21E-06	2.74E-03	7.84	6.23E-08	6.38E-06
^{79}Se	2.72E-08	2.32E-05	6.65E-02	1.70E-09	5.29E-08
^{90}Sr	4.10E-03	3.50	1.00E+04	1.03E-04	8.14E-03
^{90}Y	4.10E-03	3.51	1.00E+04	1.03E-04	8.14E-03
^{93}Zr	1.31E-07	1.12E-04	0.321	8.17E-09	2.55E-07
^{93m}Nb	5.74E-08	4.90E-05	0.140	5.44E-09	1.10E-07
^{99}Tc	9.44E-07	8.06E-04	2.31	9.18E-08	1.80E-06
^{106}Ru	2.90E-04	0.248	710	2.89E-04	2.90E-04
^{113m}Cd	1.38E-06	1.18E-03	3.37	5.13E-08	2.72E-06
^{125}Sb	7.74E-05	6.62E-02	189	1.25E-06	1.54E-04
^{126}Sn	4.28E-08	3.66E-05	0.105	2.61E-09	8.34E-08
^{129}I	1.89E-09	1.61E-06	4.62E-03	1.78E-10	3.62E-09
^{134}Cs	3.43E-05	2.93E-02	83.9	5.30E-07	6.84E-05

Table A3-2. Historical Tank Inventory Estimate.[1, 2] (4 sheets)

Total Inventory Estimate					
Radiological Constituents (Cont'd)	Ci/L	μCi/g	Ci[6]	-95 CI (Ci/L)	+95 CI (Ci/L)
^{137}Cs	4.86E-03	4.16	1.19E+04	1.44E-04	9.63E-03
^{137m}Ba	4.60E-03	3.93	1.12E+04	1.36E-04	9.11E-03
^{151}Sm	9.41E-05	8.05E-02	230	5.98E-06	1.83E-04
^{152}Eu	6.25E-07	5.34E-04	1.53	5.42E-07	7.08E-07
^{154}Eu	2.41E-05	2.06E-02	58.9	5.86E-07	4.78E-05
^{155}Eu	1.13E-04	9.68E-02	277	9.82E-05	1.28E-04
^{226}Ra	2.67E-13	2.28E-10	6.53E-07	6.16E-14	4.75E-13
^{228}Ra	1.36E-10	1.16E-07	3.32E-04	8.32E-11	2.00E-10
^{227}Ac	1.59E-12	1.36E-09	3.88E-06	4.06E-13	2.78E-12
^{231}Pa	8.49E-12	7.25E-09	2.07E-05	1.74E-12	1.53E0-11
^{229}Th	3.16E-12	2.70E-09	7.73E-06	2.01E-12	4.57E-12
^{232}Th	1.15E-11	9.81E-09	2.81E-05	5.56E-12	1.47E-11
^{232}U	1.15E-09	9.86E-07	2.82E-03	5.47E-10	1.43E-09
^{233}U	2.08E-09	1.78E-06	5.10E-03	1.28E-09	3.07E-09
^{234}U	2.75E-06	2.35E-03	6.73	1.91E-08	3.98E-06
^{235}U	1.05E-07	8.94E-05	0.256	7.26E-10	1.51E-07
^{236}U	2.26E-07	1.94E-04	0.554	1.56E-09	3.27E-07
^{238}U	1.89E-06	1.61E-03	4.62	1.33E-08	2.73E-06
^{237}Np	1.29E-08	1.11E-05	3.17E-02	4.71E-10	2.55E-08
^{238}Pu	6.82E-05	5.83E-02	167	1.91E-07	7.15E-05
^{239}Pu	5.52E-04	0.472	1.35E+03	1.56E-06	5.79E-04
^{240}Pu	1.68E-04	0.143	410	4.71E-07	1.76E-04
^{241}Pu	6.96E-03	5.95	1.70E+04	1.95E-05	7.30E-03
^{242}Pu	2.60E-08	2.22E-05	6.35E-02	7.26E-11	2.72E-08
^{241}Am	1.60E-5	1.37E-2	39.1	2.71E-7	6.38E-5
^{243}Am	3.36E-9	2.87E-6	8.22E-3	5.28E-11	1.34E-8

Table A3-2. Historical Tank Inventory Estimate.[1, 2] (4 sheets)

Total Inventory Estimate					
Radiological Constituents (Cont'd)	**Ci/L**	**μCi/g**	**Ci[6]**	**-95 CI (Ci/L)**	**+95 CI (Ci/L)**
^{242}Cm	5.50E-8	4.70E-5	0.134	4.77E-8	6.23E-8
^{243}Cm	9.20E-9	7.87E-6	2.25E-2	7.98E-9	1.04E-8
^{244}Cm	6.12E-8	5.23E-5	0.150	1.00E-9	2.64E-7
Totals	***M***	**μg/g**	**kg**	**-95 CI (*M* or g/L)**	**+95 CI (*M* or g/L)**
Pu	9.70E-3 (g/L)	-------	23.7	2.73E-5	1.02E-2
U	2.38E-2	4.85E+3	1.39E+4	1.66E-4	3.45E-2

Notes:

[1]Agnew et al. (1997a)

[2]These predictions have not been validated and should be used with caution.

[3]Volume does not include 500 kL (132 kgal) transferred to tank 241-AP-107 or evaporation losses.

[4]This is the volume average for density, mass average water wt% and TOC wt% carbon.

[5]Differences exist among the inventories in this column and the inventories calculated from the two sets of concentrations.

[6]Unknowns in tank solids inventory are assigned by the TLM.

A4.0 SURVEILLANCE DATA

Tank 241-AW-103 surveillance consists of surface-level measurements (liquid and solid) and temperature monitoring inside the tank (waste and headspace). Surveillance data provide the basis for determining tank integrity.

Liquid-level measurements can indicate whether the tank has a major leak. Solid surface-level measurements indicate physical changes in and consistencies of the solid layers of a tank.

A4.1 SURFACE-LEVEL READINGS

Surface-level measurements were originally carried out using an automatic Food Instrument Corporation gauge from August 1980 to March 1996. A manual Food Instrument Corporation gauge was installed in July 1983 and operated until May 1996. Currently, there are two techniques for monitoring the surface levels: a manual ENRAF™ gauge in riser 204 with readings beginning in May 1996 and a manual tape in riser 201 with readings beginning in May 1983. Manual readings are required daily if the ENRAF™ gauge fails. According to the Surveillance Analysis Computer System database on March 31, 1998, the manual ENRAF™ gave a reading of 186.58 in. and a manual tape reading of 185.25 in. The surface-level plot indicates a steady waste level from the fourth quarter of 1995 through the first quarter of 1998. Figure A4-1 is a level history graph of the volume.

A4.2 INTERNAL TANK TEMPERATURES

Temperatures within tank 241-AW-103 are measured by 18 thermocouple probes in riser 206 (see Figure A2-1). The lowest in-tank thermocouple, 1, is located about 10 cm (4 in.) above the tank bottom; 17 other thermocouples are spaced vertically at 61 cm (2 ft) intervals (Tran 1993). Temperature data from the Surveillance Analysis Computer System were recorded from July 1989 to February 1994 for thermocouples 1, 2, 3, 4, 5, 6, 7, 8, 11, 17, and 18. Temperature data were recorded from February 1994 to January 1998 for thermocouples 1, 3, 5, 7, 11, and 17.

From July 1989 to January 1998, the average temperature was 20 °C (66.8 °F), the minimum was 12.8 °C (55 °F), and the maximum was 36 °C (96 °F).

The minimum temperature on December 29, 1997 was 16 °C (60 °F) on thermocouples 7, 11, and 17. The maximum temperature on the same date was 18 °C (65 °F) on thermocouple 3. For plots of the thermocouple readings, refer Brevick to et al. 1997. Figure A4-2 is a graph of the weekly high temperature.

A4.3 TANK 241-AW-103 PHOTOGRAPHS

No in-tank photographs are available.

Figure A4-1. Tank 241-AW-103 Level History.

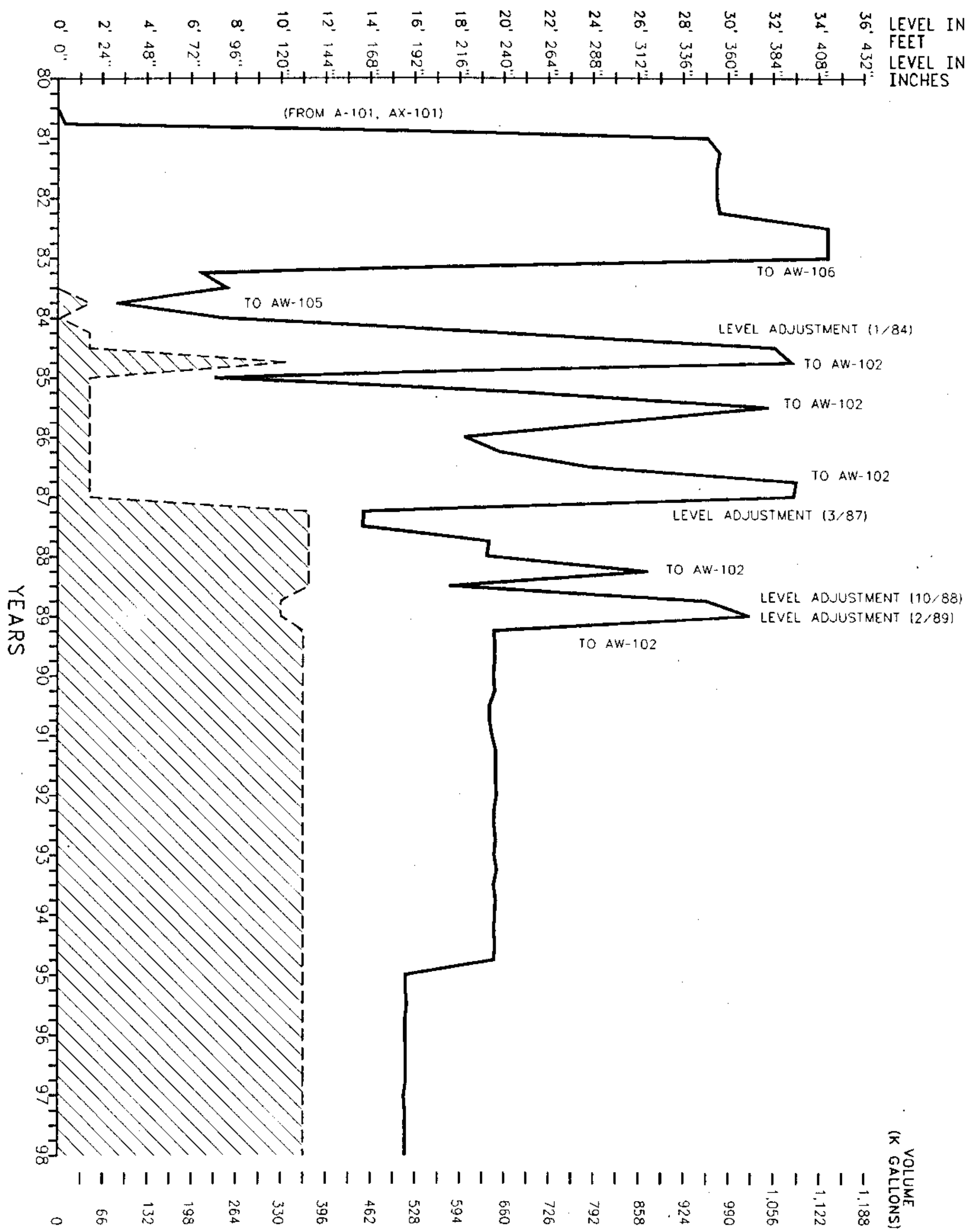
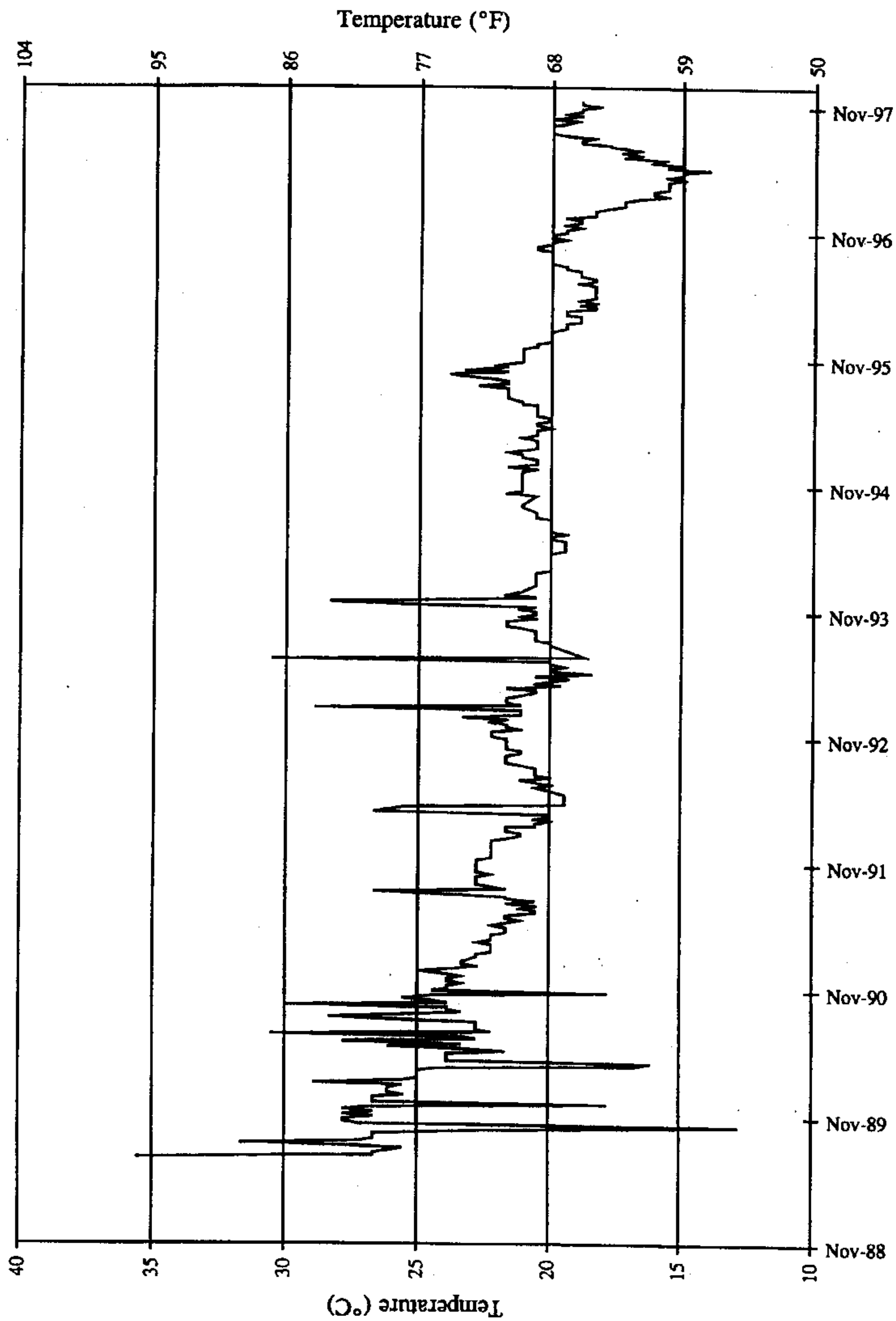


Figure A4-2. Tank 241-AW-103 High Temperature Plot.



A5.0 APPENDIX A REFERENCES

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APPENDIX B

SAMPLING OF TANK 241-AW-103

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APPENDIX B

SAMPLING OF TANK 241-AW-103

Appendix B provides sampling and analysis information for each known sampling event for tank 241-AW-103 and assesses the push mode core sample results. It includes the following:

- **Section B1.0**: Tank Sampling Overview
- **Section B2.0**: Sampling Events
- **Section B3.0**: Assessment of Characterization Results
- **Section B4.0**: Appendix B References.

B1.0 TANK SAMPLING OVERVIEW

This section describes the three latest sampling and analysis events for tank 241-AW-103 with emphasis on the most recent 1997 core sampling of tank 241-AW-103. The tank liquids and solids were sampled using the push mode core sampler in 1989, and three supernatant grab samples were taken in 1994. In 1997, two core samples, each containing segments 4 through 10, were obtained from tank 241-AW-103 to satisfy the requirements of the *Tank Safety Screening Data Quality Objective* (Dukelow et al. 1995). The requirement of obtaining two vertical profiles was satisfied by these analytical results in conjunction with the analytical results from the 1994 supernatant samples. For further discussions of the sampling and analysis procedures, refer to the *Tank Characterization Reference Guide* (DeLorenzo et al. 1994).

B2.0 SAMPLING EVENTS

This section describes sampling events. Table B2-1 summarizes the sampling and analytical requirements from the applicable DQO.

Table B2-1. Integrated Data Quality Objective Requirements for Tank 241-AW-103.[1]

Sampling Event	Applicable DQOs	Sampling Requirements	Analytical Requirements
Push mode core sampling	Safety screening - Energetics - Criticality - Moisture Content - Total Alpha - Flammable gas Dukelow et al. (1995) Pretreatment Privatization	Core samples from a minimum of two risers separated radially to the maximum extent possible. Combustible gas	Flammability, energetics, moisture, total alpha activity, density, anions, cations, radionuclides, TOC, separable organics, physical properties, TIC, pH, Cr (VI)
Vapor sampling	Organic solvents Meacham et al. (1997)	Organic component concentrations in tank headspace	Concentration, mass fraction, temperature
Grab sample	Compatibility	Liquid/supernatant	Anions, cations, pH

Note:

[1]Benar (1997)

B2.1 1997 PUSH MODE SAMPLING EVENT

Two core samples were collected from tank 241-AW-103 from risers 10A and 12A on May 2 through May 9, 1997. Seven push mode core segments were removed from each riser and analyzed in accordance with the *Tank 241-AW-103 Push Mode Core Sampling and Analysis Plan* (Benar 1997). The samples were received, extruded, and analyzed by the 222-S Laboratory and underwent analyses consistent with the *Tank Safety Screening Data Quality Objective* (Dukelow et al. 1995).

B2.1.1 Sample Handling (1997)

The push mode samples were shipped to the 222-S Laboratory for subsampling and analysis. Samples were assigned LABCORE numbers and were subjected to visual inspection for color, clarity, and solids content. The radiation dose rate on contact was also measured. Drainable liquid (and liner liquid when present in sufficient amount) was collected and clarified by centrifugation. Segments containing solids were divided into upper and lower half segments. Table B2-2 summarizes the sample extrusion results for tank 241-AW-103 core segment from cores 193 and 194. For each segment, the solid and liquid recoveries and a description of the material, as it was extruded, are included.

Table B2-2. Tank 241-AW-103 Subsampling Scheme and Sample Description.[1]

Segment	Solid (g)	Liquid (g)	Sample Portion	Sample Characteristics
Core 193				
4	76.1	0	Lower half	White sludge slurry
	0	182.9	Drainable liquid	White opaque liquid
5	178.2	0	Upper half	White wet sludge
	170.5	0	Lower half	White sludge slurry
6	186.1	0	Upper half	White wet sludge
	197.6	0	Lower half	White wet sludge
7	204.5	0	Upper half	White wet sludge
	210.2	0	Lower half	White wet sludge
8	220.5	0	Upper half	White wet sludge
	200.3	0	Lower half	White wet sludge
9	172.7	0	Upper half	White wet sludge
	201.7	0	Lower half	White wet sludge
10	96.9	0	Lower half	Dark gray sludge slurry
Core 194				
4	31.3	0	Lower half	White sludge slurry
	0	247.8	Drainable liquid	White opaque liquid
5	188.7	0	Upper half	White wet sludge
	170.9	0	Lower half	White wet sludge
6	180.1	0	Upper half	White wet sludge
	203.8	0	Lower half	White wet sludge
7	199.5	0	Upper half	White wet sludge
	205.5	0	Lower half	White wet sludge
8	214.5	0	Upper half	White wet sludge
	216.8	0	Lower half	White wet sludge
9	257.6	0	Upper half	White wet sludge
	257.7	0	Lower half	White wet sludge
10	286.3	0	Lower half	Black sludge slurry

Note:

[1]Steen (1998)

B2.1.2 Sample Analysis (1997)

The analyses performed on the core smples were not limited to those required by the safety screening DQO (Dukelow et al. 1995). The analyses required by the safety screening DQO included analyses for thermal properties by DSC, moisture content by thermogravimetric analysis (TGA), and content of fissile material by total alpha activity analysis. Opportunistic ICP and IC analysis were performed on the solid half segments as requested in Kristofzski (1996).

Quality control tests included performing the analyses in duplicate and using standards. Moisture content was measured by a gravimetric method.

Differential scanning calorimetry and TGA were performed on the samples. Quality control tests included performing the analyses in duplicate and using standards. The moisture content was also measured by a gravimetric method.

Total alpha activity measurements were performed on samples that had been fused in a solution of potassium hydroxide, then dissolved in acid. The resulting solution was dried on a counting planchet and counted in an alpha proportional counter. Quality control tests included standards, spikes, blanks, and duplicate analyses.

Ion chromatography was performed on samples that had been prepared by water digestion. Quality control tests included standards, spikes, blanks, and duplicate analyses. The SAP (Benar 1997) required measuring the full suite of IC analytes.

Inductively coupled plasma (ICP) spectrometry was performed initially on samples that had been prepared by a fusion procedure followed by dissolution in acid. Quality control tests included standards, blanks, spikes, and duplicate analyses. The SAP required analyzing the full suite of ICP elements.

All reported analyses were performed according to approved laboratory procedures. Table B2-3 lists the approved laboratory procedures used for the reported analyses. Table B2-4 summarizes sample portions, sample numbers, and analyses performed on each sample.

Table B2-3. Analytical Procedures.[1]

Analysis	Method	Procedure Number
Energetics	Differential scanning calorimeter	LA-514-114
Percent water	Thermogravimetic analysis gravimetry	LA-514-114 LA-564-101
Total alpha activity	Alpha proportional counter	LA-508-101
Flammable gas	Combustible gas analyzer	WHC-IP-0030 IH 1.4 and IH 2.1[2]
TOC/TIC	Coulometer	LA-342-100
Metals by ICP/AES	Inductively coupled plasma spectrometer	LA-505-151 LA-505-161
Anions by IC	Ion chromatograph	LA-533-105
Specific gravity	Liquid	LA-510-112
Bulk density	Solid	LO-160-103

Notes:

[1] Steen (1998)

[2] Safety Department Administrative Manuals, Westinghouse Hanford Company, Richland, Washington: IH 1.4, Industrial Hygiene Direct Reading Instrument Survey; IH 2.1, Standard Operating Procedure, MSA Model 260 Combustible Gas and Oxygen Analyzer

Table B2-4. Tank 241-AW-103 Sample Analysis Summary. (4 sheets)

Riser	Sample Identification	Sample Portion	Sample Number	Analyses
10A	Core 193, segment 4	Drainable liquid	S97T000881	SpG, ICP, IC, DSC/TGA, alpha rad
		Lower segment	S97T000873	Bulk density
			S97T000878	TIC/TOC, percent water, DSC/TGA
			S97T000888	ICP, alpha
			S97T000891	IC
10A	Core 193, segment 5	Upper segment	S97T000879	Percent water, DSC/TGA
			S97T000889	ICP
			S97T000892	IC
		Lower segment	S97T000876	Bulk density
			S97T000880	Percent water, DSC/TGA
			S97T000890	ICP, alpha
			S97T000893	IC
10A	Core 193, segment 6	Upper segment	S97T000976	Percent water, DSC/TGA
			S97T000994	ICP
			S97T001003	IC
		Lower segment	S97T000971	Bulk density
			S97T000980	Percent water, DSC/TGA
			S97T000998	ICP, alpha
			S97T001007	IC

Table B2-4. Tank 241-AW-103 Sample Analysis Summary. (4 sheets)

Riser	Sample Identification	Sample Portion	Sample Number	Analyses
10A	Core 193, segment 7	Upper segment	S97T000977	Percent water, DSC/TGA
			S97T000995	ICP
			S97T001004	IC
		Lower segment	S97T000972	Bulk density
			S97T000981	Percent water, DSC/TGA
			S97T000999	ICP, alpha
			S97T001008	IC
10A	Core 193, segment 8	Upper segment	S97T000978	Percent water, DSC/TGA
			S97T000996	ICP
			S97T001005	IC
		Lower segment	S97T000973	Bulk density
			S97T000982	Percent water, DSC/TGA, DSC
			S97T001000	ICP, alpha
			S97T001009	IC
10A	Core 193, segment 9	Upper segment	S97T000979	Percent water, DSC/TGA
			S97T000997	ICP
			S97T001006	IC
		Lower segment	S97T000974	Bulk density
			S97T000983	TIC/TOC, percent water, DSC/TGA, DSC
			S97T001001	ICP, alpha
10A	Core 193, segment 10	Lower segment	S97T001010	IC
			S97T000975	Bulk density
			S97T000984	TIC/TOC, percent water, DSC/TGA
			S97T001002	ICP, alpha
			S97T001011	IC

Table B2-4. Tank 241-AW-103 Sample Analysis Summary. (4 sheets)

Riser	Sample Identification	Sample Portion	Sample Number	Analyses
12A	Core 194, segment 4	Drainable liquid	S97T001079	SpG, ICP, IC, DSC/TGA, alpha rad
		Lower segment	S97T001035	Percent water, DSC/TGA
			S97T001059	ICP, alpha
			S97T001071	IC
12A	Core 194, segment 5	Upper segment	S97T001030	Percent water, DSC/TGA
			S97T001054	ICP
			S97T001066	IC
		Lower segment	S97T001024	Bulk density
			S97T001036	Percent water, DSC/TGA
			S97T001060	ICP, alpha
			S97T001072	IC
12A	Core 194, segment 6	Upper half	S97T001031	Percent water, DSC/TGA
			S97T001055	ICP
			S97T001067	IC
		Lower half	S97T001025	Bulk density
12A	Core 194, segment 6	Lower half	S97T001037	Percent water, DSC/TGA
			S97T001061	ICP, alpha
			S97T001073	IC
12A	Core 194, segment 7	Upper half	S97T001032	Percent water, DSC/TGA
			S97T001056	ICP
			S97T001068	IC
		Lower half	S97T001026	Bulk density
			S97T001038	Percent water, DSC/TGA
			S97T001062	ICP, alpha
			S97T001074	IC

Table B2-4. Tank 241-AW-103 Sample Analysis Summary. (4 sheets)

Riser	Sample Identification	Sample Portion	Sample Number	Analyses
12A	Core 194, segment 8	Upper half	S97T001033	Percent water, DSC/TGA
			S97T001057	ICP
			S97T001069	IC
		Lower half	S97T001027	Bulk density
			S97T001039	Percent water, DSC/TGA
			S97T001063	ICP, alpha
			S97T001075	IC
12A	Core 194, segment 9	Upper half	S97T001034	Percent water, DSC/TGA
			S97T001058	ICP
			S97T001070	IC
		Lower half	S97T001028	Bulk density
12A	Core 194, segment 9	Lower half	S97T001040	Percent water, DSC/TGA
			S97T001064	ICP, alpha
			S97T001076	IC
12A	Core 194, segment 10	Lower half	S97T001029	Bulk density
			S97T001041	TIC/TOC, percent water, DSC/TGA
			S97T001065	ICP, alpha
			S97T001077	IC

B2.1.3 Analytical Results

This section summarizes the sampling and analytical results associated with the May 1997 sampling and analysis of tank 241-AW-103. Table B2-5 lists the analyses performed and the table number associated with each analysis. These results are documented in Steen (1998).

Table B2-5. Analytical Tables.

Analysis	Table Number
Total alpha activity	B2-57
Percent water	B2-54, B2-55
Differential scanning calorimetry	B2-52
Summary data for metals by ICP	B2-7 through B2-41
Anions by IC	B2-43 through B2-50
Bulk density	B2-51
Specific gravity	B2-56
TIC	B2-58
TOC	B2-59

The four quality control (QC) parameters assessed in conjunction with tank 241-AW-103 samples were standard recoveries, spike recoveries, duplicate analyses (relative percent differences [RPDs]), and blanks. The QC criteria are specified in the SAP (Benar 1997). The only QC parameter for which limits are not specified in the SAP is blank contamination. The limits for blanks are set forth in guidelines followed by the laboratory, and all data results in this report have met those guidelines. In the analytical tables, the "mean" is the average of the result and duplicate value. All values, including those below the detection level (<), were averaged. If both sample and duplicate values were nondetected, or if one value was detected but the other was not, the mean is expressed as a nondetected value. If both values were detected, the mean is expressed as a detected value. Sample and duplicate pairs, in which any QC parameter was outside these limits, are footnoted in the sample mean column of the following data summary tables with an a, b, c, d, e, or f as follows:

- "a" indicates the standard recovery was below the QC limit
- "b" indicates the standard recovery was above the QC limit
- "c" indicates the spike recovery was below the QC limit
- "d" indicates the spike recovery was above the QC limit
- "e" indicates the RPD was above the QC limit
- "f" indicates blank contamination.

In the analytical tables, the "mean" is the average of the result and duplicate value. All values, including those below the detection level (<), were averaged. If both sample and duplicate values were nondetected, or if one value was detected but the other was not, the mean is expressed as a nondetected value. If both values were detected, the mean is expressed as a detected value.

B2.1.3.1 Inductively Coupled Plasma. Samples were prepared by fusion digest before being subjected to ICP analyses. Although a full suite of analytes were reported, only lithium was required by the safety screening DQO (Dukelow et al. 1995). All lithium results were less than detection levels, indicating that hydrostatic head fluid intrusion was not a problem.

The primary ICP analytes were sodium, zirconium, aluminum and uranium. Aluminum and total uranium results ranged from less than detection limits to 54,000 and 50,700 μg/g, respectively. Zirconium results ranged from less than detection limits to 1.71E+05 μg/g. Sodium results ranged from 58,400 μg/g for the solids to 2.36E+05 μg/g in the liquids and the low was 24,500 μg/ml. The potassium and nickel results for the ICP fusion analyses are not included because the samples were prepared in a nickel crucible by fusion using potassium hydroxide.

B2.1.3.2 Ion Chromatography. Samples were prepared by water digest before being subjected to an IC analysis. Although a full suite of analytes were reported, only bromide was required by the safety screening DQO (Dukelow et al. 1995).

All bromide analytical results were below detection limits, indicating that hydrostatic head fluid intrusion was not a problem. The primary IC analytes were fluoride, nitrate, and nitrite.

B2.1.3.3 Carbon Analyses. Total inorganic carbon (TIC) and total organic carbon (TOC) persulfate analyses were performed on samples that exhibited exothermic energy. Results ranged from 892 μg/g to 1,950 μg/g for TIC and 195 μg/g to 11,100 μg/g for TOC.

B2.1.3.4 Total Alpha Activity. Analyses for total alpha activity were performed on the samples that were prepared by fusion digestion. Two fusions were prepared per sample (for duplicate results). Each fused dilution was analyzed twice, and the results were averaged and reported as one value. The highest result returned was 1.1 μCi/g, from sample number S97T000890, at core 193, segment 5, lower half.

B2.1.3.5 Bulk Density. Bulk density measurements were performed on 13 solid subsamples. As directed by Benar (1997), bulk density was performed only on the lower half segments. The average bulk density was 1.49 g/mL with results ranging between 1.27 g/mL and 1.73 g/mL.

B2.1.3.6 Thermogravimetric Analysis. Thermogravimetric analysis measures the mass of a sample as its temperature is increased at a constant rate. Nitrogen is passed over the sample during heating to remove any released gases. A decrease in the weight of a sample during TGA represents a loss of gaseous matter from the sample, through evaporation or through a reaction that forms gas phase products. The moisture content is estimated by assuming that all TGA sample weight loss up to a certain temperature (typically 150 to 200 °C [300 to 390 °F]) is caused by water evaporation. The temperature limit for moisture loss is chosen by the operator at an inflection point on the TGA plot. Other volatile matter fractions can often be differentiated by inflection points as well.

Thermogravimetric analysis was performed in duplicate on direct subsamples from tank 241-AW-103. Results gave an average of 55.0 weight percent water and ranged from 36.5 to 73.8 percent water for solids. The average for the drainable liquid was 92.3 percent water.

B2.1.3.7 Differential Scanning Calorimetry. In a DSC analysis, heat absorbed or emitted by a substance is measured while the sample is heated at a constant rate. Nitrogen is passed over the sample material to remove any gases being released. The onset temperature for an endothermic or exothermic event is determined graphically. Quality control tests included performing the analyses in duplicate and the use of standards.

The DSC analyses for tank 241-AW-103 were performed in duplicate on direct subsamples. The DSC results indicated exotherms were present in primary/duplicate samples of core 193, segment 4, lower half, and core 194, segment 10, lower half.

B2.1.3.8 Specific Gravity. The mean specific gravity for both samples of drainable liquid was 1.015. The value of 1.015 meets the waste compatibility DQO (Carothers 1994) criterion of less than 1.41.

B2.2 VAPOR PHASE MEASUREMENT

Vapor space measurements were made on May 1, 1997, in the tank dome space as Survey #97-0187. These measurements supported the safety screening DQO (Dukelow et al. 1995) and the organic solvents DQO (Meacham et al. 1997). The vapor phase screening was taken for flammability issues. The vapor phase measurements were taken 20 ft below riser 6 in the dome space of the tank, and results were obtained in the field (that is, no gas sample was sent to the laboratory for analysis). Table B2-6 shows the results of the vapor phase measurements.

Table B2-6. Results of Headspace Measurements of Tank 241-AW-103.

Measurement	Result
	May 1, 1997
Total organic carbon	2 ppm
Lower explosive limit	3.6% of the lower explosive limit
Oxygen	20.9%
Ammonia	200 ppm

Tables B2-7 through B2-59 show analytical results. The analytical results used to characterize current tank contents were the 1997 core sample results for segments 4 to 10 and 1994 grab sample supernatant results for segments 1 to 3.

Table B2-7. Tank 241-AW-103 Analytical Results: Aluminum (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T000888	193:4	Lower half	<1,020	<1,020	<1,020
S97T000889	193:5	Upper half	<1,020	<1,020	<1,020
S97T000890		Lower half	<1,020	<1,010	<1,020
S97T000994	193:6	Upper half	<1,040	<1,030	<1,040
S97T000998		Lower half	<1,070	<1,090	<1,080
S97T000995	193:7	Upper half	<1,040	<1,040	<1,040
S97T000999		Lower half	<1,020	<1,010	<1,020
S97T000996	193:8	Upper half	2,290	2,450	2,370
S97T001000		Lower half	<1,010	<1,010	<1,010
S97T000997	193:9	Upper half	3,950	4,210	4,080
S97T001001		Lower half	7,860	7,850	7,860
S97T001002	193:10	Lower half	38,900	39,000	39,000
S97T001059	194:4	Lower half	<991	<995	<993
S97T001054	194:5	Upper half	1,410	1,150	1,280[QC:e]
S97T001060		Lower half	<991	<1,030	<1,010
S97T001055	194:6	Upper half	<1,010	<1,010	<1,010
S97T001061		Lower half	<1,020	<1,030	<1,030
S97T001056	194:7	Upper half	1,200	<1,010	<1,110
S97T001062		Lower half	1,180	4,110	2,650[QC:e]
S97T001057	194:8	Upper half	3,020	2,590	2,810
S97T001063		Lower half	4,220	4,170	4,200
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T001058	194:9	Upper half	5,960	5,950	5,960
S97T001064		Lower half	7,880	7,760	7,820
S97T001065	194:10	Lower half	53,700	54,300	54,000
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T000881	193:4	Drainable liquid	50.5	47.6	49
S97T001079	194:4	Drainable lquid	98.8	61.3	80[QC:e]

Table B2-8. Tank 241-AW-103 Analytical Results: Antimony (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T000888	193:4	Lower half	1,560	1,460	1,510
S97T000889	193:5	Upper half	1,830	2,020	1,930
S97T000890		Lower half	<1,220	<1,220	<1,220
S97T000994	193:6	Upper half	<1,240	<1,240	<1,240
S97T000998		Lower half	<1,280	1,340	<1,310
S97T000995	193:7	Upper half	<1,250	<1,250	<1,250
S97T000999		Lower half	<1,220	<1,210	<1,220
S97T000996	193:8	Upper half	<1,150	<1,140	<1,150
S97T001000		Lower half	2,010	<1,220	<1,620
S97T000997	193:9	Upper half	2,090	<1,200	<1,650
S97T001001		Lower half	3,530	3,250	3,390
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T001002	193:10	Lower half	2,340	2,420	2,380
S97T001059	194:4	Lower half	<1,190	<1,190	<1,190
S97T001054	194:5	Upper half	1,210	<1,190	<1,200
S97T001060		Lower half	1,240	<1,230	<1,240
S97T001055	194:6	Upper half	<1,220	<1,220	<1,220
S97T001061		Lower half	2,510	<1,230	<1,870[QC:e]
S97T001056	194:7	Upper half	1,470	<1,210	<1,340
S97T001062		Lower half	<591	<578	<585
S97T001057	194:8	Upper half	<597	<600	<599
S97T001063		Lower half	<579	<587	<583
S97T001058	194:9	Upper half	<597	<590	<594
S97T001064		Lower half	<596	<596	<596
S97T001065	194:10	Lower half	<590	<595	<593
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T000881	193:4	Drainable liquid	<12.1	<12.1	<12.1
S97T001079	194:4	Drainable liquid	<12.1	<12.1	<12.1

Table B2-9. Tank 241-AW-103 Analytical Results: Arsenic (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T000888	193:4	Lower half	<2,030	<2,030	<2,030
S97T000889	193:5	Upper half	<2,040	<2,040	<2,040
S97T000890		Lower half	<2,030	<2,030	<2,030
S97T000994	193:6	Upper half	<2,070	<2,070	<2,070
S97T000998		Lower half	<2,140	<2,170	<2,160
S97T000995	193:7	Upper half	<2,080	<2,090	<2,090
S97T000999		Lower half	<2,040	<2,010	<2,030
S97T000996	193:8	Upper half	<1,920	<1,900	<1,910
S97T001000		Lower half	<2,030	<2,030	<2,030
S97T000997	193:9	Upper half	<1,970	<2,000	<1,990
S97T001001		Lower half	<1,960	<1,950	<1,960
S97T001002	193:10	Lower half	<1,940	<1,990	<1,970
S97T001059	194:4	Lower half	<1,980	<1,990	<1,990
S97T001054	194:5	Upper half	<2,000	<1,990	<2,000
S97T001060		Lower half	<1,980	<2,060	<2,020
S97T001055	194:6	Upper half	<2,030	<2,030	<2,030
S97T001061		Lower half	<2,050	<2,060	<2,060
S97T001056	194:7	Upper half	<2,020	<2,010	<2,020
S97T001062		Lower half	<985	<963	<974
S97T001057	194:8	Upper half	<994	<1,000	<997
S97T001063		Lower half	<964	<978	<971
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T001058	194:9	Upper half	<995	<984	<990
S97T001064		Lower half	<994	<994	<994
S97T001065	194:10	Lower half	<984	<992	<988
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T000881	193:4	Drainable liquid	<20.1	<20.1	<20.1
S97T001079	194:4	Drainable liquid	<20.1	<20.1	<20.1

Table B2-10. Tank 241-AW-103 Analytical Results: Barium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T000888	193:4	Lower half	<1,020	<1,020	<1,020
S97T000889	193:5	Upper half	<1,020	<1,020	<1,020
S97T000890		Lower half	<1,020	<1,010	<1,020
S97T000994	193:6	Upper half	<1,040	<1,030	<1,040
S97T000998		Lower half	<1,070	<1,090	<1,080
S97T000995	193:7	Upper half	<1,040	<1,040	<1,040
S97T000999		Lower half	<1,020	<1,010	<1,020
S97T000996	193:8	Upper half	<959	<949	<954
S97T001000		Lower half	<1,010	<1,010	<1,010
S97T000997	193:9	Upper half	<987	<1,000	<994
S97T001001		Lower half	<979	<973	<976
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T001002	193:10	Lower half	<971	<993	<982
S97T001059	194:4	Lower half	<991	<995	<993
S97T001054	194:5	Upper half	<999	<994	<997
S97T001060		Lower half	<991	<1,030	<1,010
S97T001055	194:6	Upper half	<1,010	<1,010	<1,010
S97T001061		Lower half	<1,020	<1,030	<1,030
S97T001056	194:7	Upper half	<1,010	<1,010	<1,010
S97T001062		Lower half	<493	<482	<488
S97T001057	194:8	Upper half	<497	<500	<499
S97T001063		Lower half	<482	<489	<486
S97T001058	194:9	Upper half	<498	<492	<495
S97T001064		Lower half	<497	<497	<497
S97T001065	194:10	Lower half	<492	<496	<494
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T000881	193:4	Drainable liquid	<10.1	<10.1	<10.1
S97T001079	194:4	Drainable liquid	<10.1	<10.1	<10.1

Table B2-11. Tank 241-AW-103 Analytical Results: Beryllium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T000888	193:4	Lower half	128	126	127
S97T000889	193:5	Upper half	155	152	154
S97T000890		Lower half	119	123	121
S97T000994	193:6	Upper half	<104	<103	<104
S97T000998		Lower half	<107	<109	<108
S97T000995	193:7	Upper half	<104	<104	<104
S97T000999		Lower half	109	105	107
S97T000996	193:8	Upper half	<95.9	97.7	<96.8
S97T001000		Lower half	<101	<101	<101
S97T000997	193:9	Upper half	<98.7	<100	<99.3
S97T001001		Lower half	<97.9	<97.3	<97.6
S97T001002	193:10	Lower half	<97.1	<99.3	<98.2
S97T001059	194:4	Lower half	<99.1	<99.5	<99.3
S97T001054	194:5	Upper half	129	138	134
S97T001060		Lower half	127	140	134
S97T001055	194:6	Upper half	104	<101	<103
S97T001061		Lower half	112	<103	<108
S97T001056	194:7	Upper half	<101	109	<105
S97T001062		Lower half	93.3	63.9	78.6[QC:e]
S97T001057	194:8	Upper half	87.4	80	83.7
S97T001063		Lower half	75.1	69.5	72.3
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T001058	194:9	Upper half	71.7	67.7	69.7
S97T001064		Lower half	<49.7	<49.7	<49.7
S97T001065	194:10	Lower half	<49.2	<49.6	<49.4
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T000881	193:4	Drainable liquid	<1.01	<1.01	<1.01
S97T001079	194:4	Drainable liquid	<1.01	<1.01	<1.01

Table B2-12. Tank 241-AW-103 Analytical Results: Bismuth (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T000888	193:4	Lower half	<2,030	<2,030	<2,030
S97T000889	193:5	Upper half	<2,040	<2,040	<2,040
S97T000890		Lower half	<2,030	<2,030	<2,030
S97T000994	193:6	Upper half	<2,070	<2,070	<2,070
S97T000998		Lower half	<2,140	<2,170	<2,160
S97T000995	193:7	Upper half	<2,080	<2,090	<2,090
S97T000999		Lower half	<2,040	<2,010	<2,030
S97T000996	193:8	Upper half	<1,920	<1,900	<1,910
S97T001000		Lower half	<2,030	<2,030	<2,030
S97T000997	193:9	Upper half	<1,970	<2,000	<1,990
S97T001001		Lower half	<1,960	<1,950	<1,960
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T001002	193:10	Lower half	<1,940	<1,990	<1,970
S97T001059	194:4	Lower half	<1,980	<1,990	<1,990
S97T001054	194:5	Upper half	<2,000	<1,990	<2,000
S97T001060		Lower half	<1,980	<2,060	<2,020
S97T001055	194:6	Upper half	<2,030	<2,030	<2,030
S97T001061		Lower half	<2,050	<2,060	<2,060
S97T001056	194:7	Upper half	<2,020	<2,010	<2,020
S97T001062		Lower half	<985	<963	<974
S97T001057	194:8	Upper half	<994	<1,000	<997
S97T001063		Lower half	<964	<978	<971
S97T001058	194:9	Upper half	<995	<984	<990
S97T001064		Lower half	<994	<994	<994
S97T001065	194:10	Lower half	<984	<992	<988
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T000881	193:4	Drainable liquid	<20.1	<20.1	<20.1
S97T001079	194:4	Drainable liquid	<20.1	<20.1	<20.1

Table B2-13. Tank 241-AW-103 Analytical Results: Boron (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T000888	193:4	Lower half	<1,020	<1,020	<1,020
S97T000889	193:5	Upper half	<1,020	<1,020	<1,020
S97T000890		Lower half	<1,020	<1,010	<1,020
S97T000994	193:6	Upper half	<1,040	<1,030	<1,040
S97T000998		Lower half	<1,070	<1,090	<1,080
S97T000995	193:7	Upper half	<1,040	<1,040	<1,040
S97T000999		Lower half	<1,020	<1,010	<1,020
S97T000996	193:8	Upper half	<959	<949	<954
S97T001000		Lower half	<1,010	<1,010	<1,010
S97T000997	193:9	Upper half	<987	<1,000	<994
S97T001001		Lower half	<979	<973	<976
S97T001002	193:10	Lower half	<971	<993	<982
S97T001059	194:4	Lower half	<991	<995	<993
S97T001054	194:5	Upper half	<999	<994	<997
S97T001060		Lower half	<991	<1,030	<1,010
S97T001055	194:6	Upper half	<1,010	<1,010	<1,010
S97T001061		Lower half	<1,020	<1,030	<1,030
S97T001056	194:7	Upper half	<1,010	<1,010	<1,010
S97T001062		Lower half	806	12,200	6,500[QC:e]
S97T001057	194:8	Upper half	<497	<500	<499
S97T001063		Lower half	<482	597	<540[QC:e]
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T001058	194:9	Upper half	<498	619	<559[QC:e]
S97T001064		Lower half	683	565	624
S97T001065	194:10	Lower half	<492	<496	<494
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T000881	193:4	Drainable liquid	<10.1	<10.1	<10.1
S97T001079	194:4	Drainable liquid	<10.1	<10.1	<10.1

Table B2-14. Tank 241-AW-103 Analytical Results: Cadmium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T000888	193:4	Lower half	<102	<102	<102
S97T000889	193:5	Upper half	<102	<102	<102
S97T000890		Lower half	<102	<101	<102
S97T000994	193:6	Upper half	<104	<103	<104
S97T000998		Lower half	<107	<109	<108
S97T000995	193:7	Upper half	<104	<104	<104
S97T000999		Lower half	<102	<101	<102
S97T000996	193:8	Upper half	<95.9	<94.9	<95.4
S97T001000		Lower half	<101	<101	<101
S97T000997	193:9	Upper half	<98.7	<100	<99.3
S97T001001		Lower half	<97.9	<97.3	<97.6
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T001002	193:10	Lower half	110	100	105
S97T001059	194:4	Lower half	<99.1	<99.5	<99.3
S97T001054	194:5	Upper half	<99.9	<99.4	<99.7
S97T001060		Lower half	<99.1	<103	<101
S97T001055	194:6	Upper half	<101	<101	<101
S97T001061		Lower half	<102	<103	<103
S97T001056	194:7	Upper half	<101	<101	<101
S97T001062		Lower half	<49.3	<48.2	<48.8
S97T001057	194:8	Upper half	<49.7	<50	<49.9
S97T001063		Lower half	<48.2	<48.9	<48.5
S97T001058	194:9	Upper half	<49.8	<49.2	<49.5
S97T001064		Lower half	<49.7	<49.7	<49.7
S97T001065	194:10	Lower half	<49.2	<49.6	<49.4
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T000881	193:4	Drainable liquid	<1.01	<1.01	<1.01
S97T001079	194:4	Drainable liquid	<1.01	<1.01	<1.01

Table B2-15. Tank 241-AW-103 Analytical Results: Calcium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T000888	193:4	Lower half	<2,030	<2,030	<2,030
S97T000889	193:5	Upper half	<2,040	<2,040	<2,040
S97T000890		Lower half	<2,030	<2,030	<2,030
S97T000994	193:6	Upper half	<2,070	<2,070	<2,070
S97T000998		Lower half	<2,140	<2,170	<2,160
S97T000995	193:7	Upper half	<2,080	<2,090	<2,090
S97T000999		Lower half	<2,040	<2,010	<2,030
S97T000996	193:8	Upper half	<1,920	<1,900	<1,910
S97T001000		Lower half	<2,030	<2,030	<2,030
S97T000997	193:9	Upper half	<1,970	<2,000	<1,990
S97T001001		Lower half	<1,960	<1,950	<1,960
S97T001002	193:10	Lower half	<1,940	<1,990	<1,970
S97T001059	194:4	Lower half	<1,980	<1,990	<1,990
S97T001054	194:5	Upper half	<2,000	<1,990	<2,000
S97T001060		Lower half	<1,980	<2,060	<2,020
S97T001055	194:6	Upper half	<2,030	<2,030	<2,030
S97T001061		Lower half	<2,050	<2,060	<2,060
S97T001056	194:7	Upper half	<2,020	<2,010	<2,020
S97T001062		Lower half	<985	<963	<974
S97T001057	194:8	Upper half	<994	<1,000	<997
S97T001063		Lower half	<964	<978	<971
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T001058	194:9	Upper half	<995	<984	<990
S97T001064		Lower half	<994	<994	<994
S97T001065	194:10	Lower half	<984	<992	<988
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T000881	193:4	Drainable liquid	<20.1	<20.1	<20.1
S97T001079	194:4	Drainable liquid	<20.1	<20.1	<20.1

Table B2-16. Tank 241-AW-103 Analytical Results: Cerium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**μg/g**	**μg/g**	**μg/g**
S97T000888	193:4	Lower half	<2,030	<2,030	<2,030
S97T000889	193:5	Upper half	<2,040	<2,040	<2,040
S97T000890		Lower half	<2,030	<2,030	<2,030
S97T000994	193:6	Upper half	<2,070	<2,070	<2,070
S97T000998		Lower half	<2,140	<2,170	<2,160
S97T000995	193:7	Upper half	<2,080	<2,090	<2,090
S97T000999		Lower half	<2,040	<2,010	<2,030
S97T000996	193:8	Upper half	<1,920	<1,900	<1,910
S97T001000		Lower half	<2,030	<2,030	<2,030
S97T000997	193:9	Upper half	<1,970	<2,000	<1,990
S97T001001		Lower half	<1,960	<1,950	<1,960
Solids: fusion			**μg/g**	**μg/g**	**μg/g**
S97T001002	193:10	Lower half	<1,940	<1,990	<1,970
S97T001059	194:4	Lower half	<1,980	<1,990	<1,990
S97T001054	194:5	Upper half	<2,000	<1,990	<2,000
S97T001060		Lower half	<1,980	<2,060	<2,020
S97T001055	194:6	Upper half	<2,030	<2,030	<2,030
S97T001061		Lower half	<2,050	<2,060	<2,060
S97T001056	194:7	Upper half	<2,020	<2,010	<2,020
S97T001062		Lower half	<985	<963	<974
S97T001057	194:8	Upper half	<994	<1,000	<997
S97T001063		Lower half	<964	<978	<971
S97T001058	194:9	Upper half	<995	<984	<990
S97T001064		Lower half	<994	<994	<994
S97T001065	194:10	Lower half	<984	<992	<988
Liquids			**μg/mL**	**μg/mL**	**μg/mL**
S97T000881	193:4	Drainable liquid	<20.1	<20.1	<20.1
S97T001079	194:4	Drainable liquid	<20.1	<20.1	<20.1

Table B2-17. Tank 241-AW-103 Analytical Results: Chromium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T000888	193:4	Lower half	<203	<203	<203
S97T000889	193:5	Upper half	<204	<204	<204
S97T000890		Lower half	<203	<203	<203
S97T000994	193:6	Upper half	<207	<207	<207
S97T000998		Lower half	<214	<217	<216
S97T000995	193:7	Upper half	<208	<209	<209
S97T000999		Lower half	<204	<201	<203
S97T000996	193:8	Upper half	193	<190	<192
S97T001000		Lower half	<203	<203	<203
S97T000997	193:9	Upper half	<197	225	<211
S97T001001		Lower half	689	600	645
S97T001002	193:10	Lower half	24,200	23,900	24,100
S97T001059	194:4	Lower half	<198	<199	<199
S97T001054	194:5	Upper half	<200	<199	<200
S97T001060		Lower half	<198	<206	<202
S97T001055	194:6	Upper half	<203	<203	<203
S97T001061		Lower half	<205	<206	<206
S97T001056	194:7	Upper half	<202	<201	<202
S97T001062		Lower half	<98.5	<96.3	<97.4
S97T001057	194:8	Upper half	<99.4	<100	<99.7
S97T001063		Lower half	<96.4	<97.8	<97.1
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T001058	194:9	Upper half	<99.5	<98.4	<99
S97T001064		Lower half	<99.4	<99.4	<99.4
S97T001065	194:10	Lower half	14,200	14,800	14,500
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T000881	193:4	Drainable liquid	26.2	26	26.1
S97T001079	194:4	Drainable liquid	25.2	23.8	24.5

Table B2-18. Tank 241-AW-103 Analytical Results: Cobalt (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T000888	193:4	Lower half	<406	<407	<407
S97T000889	193:5	Upper half	<408	<408	<408
S97T000890		Lower half	<407	<405	<406
S97T000994	193:6	Upper half	<414	<414	<414
S97T000998		Lower half	<428	<434	<431
S97T000995	193:7	Upper half	<417	<418	<418
S97T000999		Lower half	<408	<402	<405
S97T000996	193:8	Upper half	<383	<380	<382
S97T001000		Lower half	<405	<405	<405
S97T000997	193:9	Upper half	<395	<400	<398
S97T001001		Lower half	<391	<389	<390
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T001002	193:10	Lower half	<388	<397	<393
S97T001059	194:4	Lower half	<396	<398	<397
S97T001054	194:5	Upper half	<399	<398	<399
S97T001060		Lower half	<397	<412	<405
S97T001055	194:6	Upper half	<405	<405	<405
S97T001061		Lower half	<409	<412	<411
S97T001056	194:7	Upper half	<404	<403	<404
S97T001062		Lower half	<197	<193	<195
S97T001057	194:8	Upper half	<199	<200	<200
S97T001063		Lower half	<193	<196	<195
S97T001058	194:9	Upper half	<199	<197	<198
S97T001064		Lower half	<199	<199	<199
S97T001065	194:10	Lower half	<197	<198	<198
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T000881	193:4	Drainable liquid	6.97	7.52	7.24
S97T001079	194:4	Drainable liquid	7.1	7.27	7.18

Table B2-19. Tank 241-AW-103 Analytical Results: Copper (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T000888	193:4	Lower half	<203	<203	<203
S97T000889	193:5	Upper half	<204	<204	<204
S97T000890		Lower half	<203	<203	<203
S97T000994	193:6	Upper half	<207	<207	<207
S97T000998		Lower half	<214	<217	<216
S97T000995	193:7	Upper half	<208	<209	<209
S97T000999		Lower half	<204	<201	<203
S97T000996	193:8	Upper half	<192	<190	<191
S97T001000		Lower half	<203	<203	<203
S97T000997	193:9	Upper half	<197	<200	<199
S97T001001		Lower half	<196	<195	<196
S97T001002	193:10	Lower half	<194	<199	<197
S97T001059	194:4	Lower half	<198	<199	<199
S97T001054	194:5	Upper half	<200	<199	<200
S97T001060		Lower half	<198	<206	<202
S97T001055	194:6	Upper half	<203	<203	<203
S97T001061		Lower half	<205	<206	<206
S97T001056	194:7	Upper half	<202	<201	<202
S97T001062		Lower half	<98.5	<96.3	<97.4
S97T001057	194:8	Upper half	<99.4	<100	<99.7
S97T001063		Lower half	<96.4	<97.8	<97.1
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T001058	194:9	Upper half	<99.5	<98.4	<99
S97T001064		Lower half	<99.4	<99.4	<99.4
S97T001065	194:10	Lower half	<98.4	<99.2	<98.8
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T000881	193:4	Drainable liquid	<2.01	<2.01	<2.01
S97T001079	194:4	Drainable liquid	<2.01	<2.01	<2.01

Table B2-20. Tank 241-AW-103 Analytical Results: Iron (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T000888	193:4	Lower half	<1,020	<1,020	<1,020
S97T000889	193:5	Upper half	<1,020	<1,020	<1,020
S97T000890		Lower half	<1,020	<1,010	<1,020
S97T000994	193:6	Upper half	<1,040	<1,030	<1,040
S97T000998		Lower half	<1,070	<1,090	<1,080
S97T000995	193:7	Upper half	<1,040	<1,040	<1,040
S97T000999		Lower half	<1,020	<1,010	<1,020
S97T000996	193:8	Upper half	964	<949	<957
S97T001000		Lower half	<1,010	<1,010	<1,010
S97T000997	193:9	Upper half	<987	<1,000	<994
S97T001001		Lower half	<979	<973	<976
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T001002	193:10	Lower half	<971	<993	<982
S97T001059	194:4	Lower half	<991	<995	<993
S97T001054	194:5	Upper half	<999	<994	<997
S97T001060		Lower half	<991	<1,030	<1,010
S97T001055	194:6	Upper half	<1,010	<1,010	<1,010
S97T001061		Lower half	<1,020	<1,030	<1,030
S97T001056	194:7	Upper half	<1,010	<1,010	<1,010
S97T001062		Lower half	<493	<482	<488
S97T001057	194:8	Upper half	619	<500	<560[QC:e]
S97T001063		Lower half	<482	<489	<486
S97T001058	194:9	Upper half	790	562	676[QC:e]
S97T001064		Lower half	<497	<497	<497
S97T001065	194:10	Lower half	678	650	664
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T000881	193:4	Drainable liquid	<10.1	<10.1	<10.1
S97T001079	194:4	Drainable liquid	<10.1	<10.1	<10.1

Table B2-21. Tank 241-AW-103 Analytical Results: Lanthanum (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T000888	193:4	Lower half	<1,020	<1,020	<1,020
S97T000889	193:5	Upper half	1,840	1,670	1,760
S97T000890		Lower half	1,340	1,150	1,250
S97T000994	193:6	Upper half	<1,040	<1,030	<1,040
S97T000998		Lower half	<1,070	<1,090	<1,080
S97T000995	193:7	Upper half	<1,040	<1,040	<1,040
S97T000999		Lower half	<1,020	<1,010	<1,020
S97T000996	193:8	Upper half	<959	<949	<954
S97T001000		Lower half	<1,010	<1,010	<1,010
S97T000997	193:9	Upper half	<987	<1,000	<994
S97T001001		Lower half	<979	<973	<976
S97T001002	193:10	Lower half	<971	<993	<982
S97T001059	194:4	Lower half	<991	<995	<993
S97T001054	194:5	Upper half	1,110	1,030	1,070
S97T001060		Lower half	1,680	1,710	1,700
S97T001055	194:6	Upper half	1,040	<1,010	<1,030
S97T001061		Lower half	<1,020	<1,030	<1,030
S97T001056	194:7	Upper half	<1,010	<1,010	<1,010
S97T001062		Lower half	<493	<482	<488
S97T001057	194:8	Upper half	<497	<500	<499
S97T001063		Lower half	<482	<489	<486
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T001058	194:9	Upper half	<498	<492	<495
S97T001064		Lower half	<497	<497	<497
S97T001065	194:10	Lower half	<492	<496	<494
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T000881	193:4	Drainable liquid	<10.1	<10.1	<10.1
S97T001079	194:4	Drainable liquid	<10.1	<10.1	<10.1

Table B2-22. Tank 241-AW-103 Analytical Results: Lead (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**μg/g**	**μg/g**	**μg/g**
S97T000888	193:4	Lower half	<2,030	<2,030	<2,030
S97T000889	193:5	Upper half	<2,040	<2,040	<2,040
S97T000890		Lower half	<2,030	<2,030	<2,030
S97T000994	193:6	Upper half	<2,070	<2,070	<2,070
S97T000998		Lower half	<2,140	<2,170	<2,160
S97T000995	193:7	Upper half	<2,080	<2,090	<2,090
S97T000999		Lower half	<2,040	<2,010	<2,030
S97T000996	193:8	Upper half	<1,920	<1,900	<1,910
S97T001000		Lower half	<2,030	<2,030	<2,030
S97T000997	193:9	Upper half	<1,970	<2,000	<1,990
S97T001001		Lower half	<1,960	<1,950	<1,960
Solids: fusion			**μg/g**	**μg/g**	**μg/g**
S97T001002	193:10	Lower half	<1,940	<1,990	<1,970
S97T001059	194:4	Lower half	<1,980	<1,990	<1,990
S97T001054	194:5	Upper half	<2,000	<1,990	<2,000
S97T001060		Lower half	<1,980	<2,060	<2,020
S97T001055	194:6	Upper half	<2,030	<2,030	<2,030
S97T001061		Lower half	<2,050	<2,060	<2,060
S97T001056	194:7	Upper half	<2,020	<2,010	<2,020
S97T001062		Lower half	<985	<963	<974
S97T001057	194:8	Upper half	<994	<1,000	<997
S97T001063		Lower half	<964	<978	<971
S97T001058	194:9	Upper half	<995	<984	<990
S97T001064		Lower half	<994	<994	<994
S97T001065	194:10	Lower half	<984	<992	<988
Liquids			**μg/mL**	**μg/mL**	**μg/mL**
S97T000881	193:4	Drainable liquid	<20.1	<20.1	<20.1
S97T001079	194:4	Drainable liquid	<20.1	<20.1	<20.1

Table B2-23. Tank 241-AW-103 Analytical Results: Lithium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T000888	193:4	Lower half	<203	<203	<203
S97T000889	193:5	Upper half	<204	<204	<204
S97T000890		Lower half	<203	<203	<203
S97T000994	193:6	Upper half	<207	<207	<207
S97T000998		Lower half	<214	<217	<216
S97T000995	193:7	Upper half	<208	<209	<209
S97T000999		Lower half	<204	<201	<203
S97T000996	193:8	Upper half	<192	<190	<191
S97T001000		Lower half	<203	<203	<203
S97T000997	193:9	Upper half	<197	<200	<199
S97T001001		Lower half	<196	<195	<196
S97T001002	193:10	Lower half	<194	<199	<197
S97T001059	194:4	Lower half	<198	<199	<199
S97T001054	194:5	Upper half	<200	<199	<200
S97T001060		Lower half	<198	<206	<202
S97T001055	194:6	Upper half	<203	<203	<203
S97T001061		Lower half	<205	<206	<206
S97T001056	194:7	Upper half	<202	<201	<202
S97T001062		Lower half	<98.5	<96.3	<97.4
S97T001057	194:8	Upper half	<99.4	<100	<99.7
S97T001063		Lower half	<96.4	<97.8	<97.1
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T001058	194:9	Upper half	<99.5	<98.4	<99
S97T001064		Lower half	<99.4	<99.4	<99.4
S97T001065	194:10	Lower half	<98.4	<99.2	<98.8
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T000881	193:4	Drainable liquid	<2.01	<2.01	<2.01
S97T001079	194:4	Drainable liquid	<2.01	<2.01	<2.01

Table B2-24. Tank 241-AW-103 Analytical Results: Magnesium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T000888	193:4	Lower half	<2,030	<2,030	<2,030
S97T000889	193:5	Upper half	<2,040	<2,040	<2,040
S97T000890		Lower half	<2,030	<2,030	<2,030
S97T000994	193:6	Upper half	<2,070	<2,070	<2,070
S97T000998		Lower half	<2,140	<2,170	<2,160
S97T000995	193:7	Upper half	<2,080	<2,090	<2,090
S97T000999		Lower half	<2,040	<2,010	<2,030
S97T000996	193:8	Upper half	<1,920	<1,900	<1,910
S97T001000		Lower half	<2,030	<2,030	<2,030
S97T000997	193:9	Upper half	<1,970	<2,000	<1,990
S97T001001		Lower half	<1,960	<1,950	<1,960
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T001002	193:10	Lower half	<1,940	<1,990	<1,970
S97T001059	194:4	Lower half	<1,980	<1,990	<1,990
S97T001054	194:5	Upper half	<2,000	<1,990	<2,000
S97T001060		Lower half	<1,980	<2,060	<2,020
S97T001055	194:6	Upper half	<2,030	<2,030	<2,030
S97T001061		Lower half	<2,050	<2,060	<2,060
S97T001056	194:7	Upper half	<2,020	<2,010	<2,020
S97T001062		Lower half	<985	<963	<974
S97T001057	194:8	Upper half	<994	<1,000	<997
S97T001063		Lower half	<964	<978	<971
S97T001058	194:9	Upper half	<995	<984	<990
S97T001064		Lower half	<994	<994	<994
S97T001065	194:10	Lower half	<984	<992	<988
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T000881	193:4	Drainable liquid	<20.1	<20.1	<20.1
S97T001079	194:4	Drainable liquid	<20.1	<20.1	<20.1

Table B2-25. Tank 241-AW-103 Analytical Results: Manganese (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T000888	193:4	Lower half	<203	<203	<203
S97T000889	193:5	Upper half	<204	<204	<204
S97T000890		Lower half	<203	<203	<203
S97T000994	193:6	Upper half	<207	<207	<207
S97T000998		Lower half	<214	<217	<216
S97T000995	193:7	Upper half	<208	<209	<209
S97T000999		Lower half	<204	<201	<203
S97T000996	193:8	Upper half	<192	<190	<191
S97T001000		Lower half	<203	<203	<203
S97T000997	193:9	Upper half	<197	<200	<199
S97T001001		Lower half	<196	<195	<196
S97T001002	193:10	Lower half	<194	<199	<197
S97T001059	194:4	Lower half	<198	<199	<199
S97T001054	194:5	Upper half	<200	<199	<200
S97T001060		Lower half	<198	<206	<202
S97T001055	194:6	Upper half	<203	<203	<203
S97T001061		Lower half	<205	<206	<206
S97T001056	194:7	Upper half	<202	<201	<202
S97T001062		Lower half	<98.5	<96.3	<97.4
S97T001057	194:8	Upper half	<99.4	<100	<99.7
S97T001063		Lower half	<96.4	<97.8	<97.1
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T001058	194:9	Upper half	<99.5	<98.4	<99
S97T001064		Lower half	<99.4	<99.4	<99.4
S97T001065	194:10	Lower half	147	156	152
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T000881	193:4	Drainable liquid	<2.01	<2.01	<2.01
S97T001079	194:4	Drainable liquid	<2.01	<2.01	<2.01

Table B2-26. Tank 241-AW-103 Analytical Results: Molybdenum (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			μg/g	μg/g	μg/g
S97T000888	193:4	Lower half	<1,020	<1,020	<1,020
S97T000889	193:5	Upper half	<1,020	<1,020	<1,020
S97T000890		Lower half	<1,020	<1,010	<1,020
S97T000994	193:6	Upper half	<1,040	<1,030	<1,040
S97T000998		Lower half	<1,070	<1,090	<1,080
S97T000995	193:7	Upper half	<1,040	<1,040	<1,040
S97T000999		Lower half	<1,020	<1,010	<1,020
S97T000996	193:8	Upper half	<959	<949	<954
S97T001000		Lower half	<1,010	<1,010	<1,010
S97T000997	193:9	Upper half	<987	<1,000	<994
S97T001001		Lower half	<979	<973	<976
Solids: fusion			μg/g	μg/g	μg/g
S97T001002	193:10	Lower half	<971	<993	<982
S97T001059	194:4	Lower half	<991	<995	<993
S97T001054	194:5	Upper half	<999	<994	<997
S97T001060		Lower half	<991	<1,030	<1,010
S97T001055	194:6	Upper half	<1,010	<1,010	<1,010
S97T001061		Lower half	<1,020	<1,030	<1,030
S97T001056	194:7	Upper half	<1,010	<1,010	<1,010
S97T001062		Lower half	<493	<482	<488
S97T001057	194:8	Upper half	<497	<500	<499
S97T001063		Lower half	<482	<489	<486
S97T001058	194:9	Upper half	<498	<492	<495
S97T001064		Lower half	<497	<497	<497
S97T001065	194:10	Lower half	<492	<496	<494
Liquids			μg/mL	μg/mL	μg/mL
S97T000881	193:4	Drainable liquid	<10.1	<10.1	<10.1
S97T001079	194:4	Drainable liquid	<10.1	<10.1	<10.1

Table B2-27. Tank 241-AW-103 Analytical Results: Neodymium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T000888	193:4	Lower half	<2,030	<2,030	<2,030
S97T000889	193:5	Upper half	<2,040	<2,040	<2,040
S97T000890		Lower half	<2,030	<2,030	<2,030
S97T000994	193:6	Upper half	<2,070	<2,070	<2,070
S97T000998		Lower half	<2,140	<2,170	<2,160
S97T000995	193:7	Upper half	<2,080	<2,090	<2,090
S97T000999		Lower half	<2,040	<2,010	<2,030
S97T000996	193:8	Upper half	<1,920	<1,900	<1,910
S97T001000		Lower half	<2,030	<2,030	<2,030
S97T000997	193:9	Upper half	<1,970	<2,000	<1,990
S97T001001		Lower half	<1,960	<1,950	<1,960
S97T001002	193:10	Lower half	<1,940	<1,990	<1,970
S97T001059	194:4	Lower half	<1,980	<1,990	<1,990
S97T001054	194:5	Upper half	<2,000	<1,990	<2,000
S97T001060		Lower half	<1,980	<2,060	<2,020
S97T001055	194:6	Upper half	<2,030	<2,030	<2,030
S97T001061		Lower half	<2,050	<2,060	<2,060
S97T001056	194:7	Upper half	<2,020	<2,010	<2,020
S97T001062		Lower half	<985	<963	<974
S97T001057	194:8	Upper half	<994	<1,000	<997
S97T001063		Lower half	<964	<978	<971
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T001058	194:9	Upper half	<995	<984	<990
S97T001064		Lower half	<994	<994	<994
S97T001065	194:10	Lower half	<984	<992	<988
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T000881	193:4	Drainable liquid	<20.1	<20.1	<20.1
S97T001079	194:4	Drainable liquid	<20.1	<20.1	<20.1

Table B2-28. Tank 241-AW-103 Analytical Results: Nickel (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			μg/mL	μg/mL	μg/mL
S97T000881	193:4	Drainable liquid	<4.02	<4.02	<4.02
S97T001079	194:4	Drainable liquid	<4.02	<4.02	<4.02

Table B2-29. Tank 241-AW-103 Analytical Results: Phosphorus (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**μg/g**	**μg/g**	**μg/g**
S97T000888	193:4	Lower half	<4,060	<4,070	<4,070
S97T000889	193:5	Upper half	<4,080	<4,080	<4,080
S97T000890		Lower half	<4,070	<4,050	<4,060
S97T000994	193:6	Upper half	<4,140	<4,140	<4,140
S97T000998		Lower half	<4,280	<4,340	<4,310
S97T000995	193:7	Upper half	<4,170	<4,180	<4,180
S97T000999		Lower half	<4,080	<4,020	<4,050
S97T000996	193:8	Upper half	<3,830	<3,800	<3,820
S97T001000		Lower half	<4,050	<4,050	<4,050
S97T000997	193:9	Upper half	<3,950	<4,000	<3,980
S97T001001		Lower half	<3,910	<3,890	<3,900
S97T001002	193:10	Lower half	13,900	12,700	13,300
S97T001059	194:4	Lower half	<3,960	<3,980	<3,970
S97T001054	194:5	Upper half	<3,990	<3,980	<3,990
S97T001060		Lower half	<3,970	<4,120	<4,050
S97T001055	194:6	Upper half	<4,050	<4,050	<4,050
S97T001061		Lower half	<4,090	<4,120	<4,110
S97T001056	194:7	Upper half	<4,040	<4,030	<4,040
S97T001062		Lower half	<1,970	<1,930	<1,950
S97T001057	194:8	Upper half	<1,990	<2,000	<2,000
S97T001063		Lower half	<1,930	<1,960	<1,950
Solids: fusion			**μg/g**	**μg/g**	**μg/g**
S97T001058	194:9	Upper half	<1,990	<1,970	<1,980
S97T001064		Lower half	<1,990	<1,990	<1,990
S97T001065	194:10	Lower half	<1,970	<1,980	<1,980
Liquids			**μg/mL**	**μg/mL**	**μg/mL**
S97T000881	193:4	Drainable liquid	<40.2	<40.2	<40.2
S97T001079	194:4	Drainable liquid	<40.2	<40.2	<40.2

Table B2-30. Tank 241-AW-103 Analytical Results: Potassium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T000881	193:4	Drainable liquid	14,800	14,200	14,500[QC:c]
S97T001079	194:4	Drainable liquid	14,200	13,800	14,000[QC:c]

Table B2-31. Tank 241-AW-103 Analytical Results: Samarium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T000888	193:4	Lower half	<2,030	<2,030	<2,030
S97T000889	193:5	Upper half	<2,040	<2,040	<2,040
S97T000890		Lower half	<2,030	<2,030	<2,030
S97T000994	193:6	Upper half	<2,070	<2,070	<2,070
S97T000998		Lower half	<2,140	<2,170	<2,160
S97T000995	193:7	Upper half	<2,080	<2,090	<2,090
S97T000999		Lower half	<2,040	<2,010	<2,030
S97T000996	193:8	Upper half	<1,920	<1,900	<1,910
S97T001000		Lower half	<2,030	<2,030	<2,030
S97T000997	193:9	Upper half	<1,970	<2,000	<1,990
S97T001001		Lower half	<1,960	<1,950	<1,960
S97T001002	193:10	Lower half	<1,940	<1,990	<1,970
S97T001059	194:4	Lower half	<1,980	<1,990	<1,990
S97T001054	194:5	Upper half	<2,000	<1,990	<2,000
S97T001060		Lower half	<1,980	<2,060	<2,020
S97T001055	194:6	Upper half	<2,030	<2,030	<2,030
S97T001061		Lower half	<2,050	<2,060	<2,060
S97T001056	194:7	Upper half	<2,020	<2,010	<2,020
S97T001062		Lower half	<985	<963	<974
S97T001057	194:8	Upper half	<994	<1,000	<997
S97T001063		Lower half	<964	<978	<971
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T001058	194:9	Upper half	<995	<984	<990
S97T001064		Lower half	<994	<994	<994
S97T001065	194:10	Lower half	<984	<992	<988
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T000881	193:4	Drainable liquid	<20.1	<20.1	<20.1
S97T001079	194:4	Drainable liquid	<20.1	<20.1	<20.1

Table B2-32. Tank 241-AW-103 Analytical Results: Silicon (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T000888	193:4	Lower half	1,810	1,760	1,790
S97T000889	193:5	Upper half	1,870	1,870	1,870
S97T000890		Lower half	2,600	2,260	2,430
S97T000994	193:6	Upper half	2,100	1,660	1,880[QC:e]
S97T000998		Lower half	3,160	2,070	2,620[QC:e]
S97T000995	193:7	Upper half	2,230	2,080	2,160
S97T000999		Lower half	2,390	1,540	1,970[QC:e]
S97T000996	193:8	Upper half	1,860	1,440	1,650[QC:e]
S97T001000		Lower half	1,740	1,700	1,720
S97T000997	193:9	Upper half	1,240	1,630	1,440[QC:e]
S97T001001		Lower half	1,490	1,230	1,360
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T001002	193:10	Lower half	<971	<993	<982
S97T001059	194:4	Lower half	1,710	1,950	1,830
S97T001054	194:5	Upper half	1,810	1,750	1,780
S97T001060		Lower half	2,130	2,130	2,130
S97T001055	194:6	Upper half	1,780	2,230	2,010[QC:e]
S97T001061		Lower half	2,290	2,080	2,190
S97T001056	194:7	Upper half	1,890	1,560	1,730
S97T001062		Lower half	8,800	13,300	11,100[QC:e]
S97T001057	194:8	Upper half	3,590	3,450	3,520
S97T001063		Lower half	3,300	7,110	5210[QC:e]
S97T001058	194:9	Upper half	5,750	6,680	6,220
S97T001064		Lower half	7,250	6,380	6,820
S97T001065	194:10	Lower half	911	776	844
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T000881	193:4	Drainable liquid	234	261	248
S97T001079	194:4	Drainable liquid	250	249	250

Table B2-33. Tank 241-AW-103 Analytical Results: Silver (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**μg/g**	**μg/g**	**μg/g**
S97T000888	193:4	Lower half	712	687	700
S97T000889	193:5	Upper half	890	824	857
S97T000890		Lower half	696	721	709
S97T000994	193:6	Upper half	594	605	600
S97T000998		Lower half	634	709	672
S97T000995	193:7	Upper half	532	586	559
S97T000999		Lower half	621	577	599
S97T000996	193:8	Upper half	550	604	577
S97T001000		Lower half	524	572	548
S97T000997	193:9	Upper half	515	508	512
S97T001001		Lower half	601	518	560
S97T001002	193:10	Lower half	<194	<199	<197
S97T001059	194:4	Lower half	415	439	427
S97T001054	194:5	Upper half	796	823	810
S97T001060		Lower half	793	816	805
S97T001055	194:6	Upper half	581	602	592
S97T001061		Lower half	663	617	640
S97T001056	194:7	Upper half	615	628	622
S97T001062		Lower half	605	477	541[QC:e]
S97T001057	194:8	Upper half	586	609	598
S97T001063		Lower half	571	541	556
Solids: fusion			**μg/g**	**μg/g**	**μg/g**
S97T001058	194:9	Upper half	558	549	554
S97T001064		Lower half	515	491	503
S97T001065	194:10	Lower half	<98.4	<99.2	<98.8[QC:c]
Liquids			**μg/mL**	**μg/mL**	**μg/mL**
S97T000881	193:4	Drainable liquid	<2.01	<2.01	<2.01
S97T001079	194:4	Drainable liquid	<2.01	<2.01	<2.01

Table B2-34. Tank 241-AW-103 Analytical Results: Sodium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**μg/g**	**μg/g**	**μg/g**
S97T000888	193:4	Lower half	1.04E+05	1.03E+05	1.04E+05
S97T000889	193:5	Upper half	51,700	65,000	58,400[QC:e]
S97T000890		Lower half	81,900	78,000	80,000
S97T000994	193:6	Upper half	1.16E+05	1.04E+05	1.10E+05
S97T000998		Lower half	83,900	83,400	83,700[QC:c]
S97T000995	193:7	Upper half	1.45E+05	1.38E+05	1.42E+05
S97T000999		Lower half	1.42E+05	1.40E+05	1.41E+05
S97T000996	193:8	Upper half	1.78E+05	1.74E+05	1.76E+05
S97T001000		Lower half	1.47E+05	1.47E+05	1.47E+05
S97T000997	193:9	Upper half	2.10E+05	2.15E+05	2.13E+05
S97T001001		Lower half	2.03E+05	1.94E+05	1.99E+05
Solids: fusion			**μg/g**	**μg/g**	**μg/g**
S97T001002	193:10	Lower half	1.91E+05	1.87E+05	1.89E+05
S97T001059	194:4	Lower half	68,900	73,600	71,300
S97T001054	194:5	Upper half	78,400	76,800	77,600
S97T001060		Lower half	58,500	58,900	58,700
S97T001055	194:6	Upper half	1.13E+05	1.17E+05	1.15E+05
S97T001061		Lower half	92,100	89,700	90,900
S97T001056	194:7	Upper half	1.31E+05	1.23E+05	1.27E+05
S97T001062		Lower half	1.91E+05	1.41E+05	1.66E+05[QC:e]
S97T001057	194:8	Upper half	1.63E+05	1.64E+05	1.64E+05
S97T001063		Lower half	1.77E+05	1.95E+05	1.86E+05
S97T001058	194:9	Upper half	2.21E+05	2.20E+05	2.21E+05
S97T001064		Lower half	2.30E+05	2.41E+05	2.36E+05
S97T001065	194:10	Lower half	1.78E+05	1.67E+05	1.73E+05[QC:c]
Liquids			**μg/mL**	**μg/mL**	**μg/mL**
S97T000881	193:4	Drainable liquid	25,400	24,100	24,800[QC:c]
S97T001079	194:4	Drainable liquid	25,000	23,900	24,500[QC:c]

Table B2-35. Tank 241-AW-103 Analytical Results: Strontium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T000888	193:4	Lower half	<203	<203	<203
S97T000889	193:5	Upper half	<204	<204	<204
S97T000890		Lower half	<203	<203	<203
S97T000994	193:6	Upper half	<207	<207	<207
S97T000998		Lower half	<214	<217	<216
S97T000995	193:7	Upper half	<208	<209	<209
S97T000999		Lower half	<204	<201	<203
S97T000996	193:8	Upper half	<192	<190	<191
S97T001000		Lower half	<203	<203	<203
S97T000997	193:9	Upper half	<197	<200	<199
S97T001001		Lower half	<196	<195	<196
S97T001002	193:10	Lower half	<194	<199	<197
S97T001059	194:4	Lower half	<198	<199	<199
S97T001054	194:5	Upper half	<200	<199	<200
S97T001060		Lower half	<198	<206	<202
S97T001055	194:6	Upper half	<203	<203	<203
S97T001061		Lower half	<205	<206	<206
S97T001056	194:7	Upper half	<202	<201	<202
S97T001062		Lower half	<98.5	<96.3	<97.4
S97T001057	194:8	Upper half	<99.4	<100	<99.7
S97T001063		Lower half	<96.4	<97.8	<97.1
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T001058	194:9	Upper half	<99.5	<98.4	<99
S97T001064		Lower half	<99.4	<99.4	<99.4
S97T001065	194:10	Lower half	<98.4	<99.2	<98.8
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T000881	193:4	Drainable liquid	<2.01	<2.01	<2.01
S97T001079	194:4	Drainable liquid	<2.01	<2.01	<2.01

Table B2-36. Tank 241-AW-103 Analytical Results: Sulfur (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T000888	193:4	Lower half	<2,030	<2,030	<2,030
S97T000889	193:5	Upper half	<2,040	<2,040	<2,040
S97T000890		Lower half	<2,030	<2,030	<2,030
S97T000994	193:6	Upper half	<2,070	<2,070	<2,070
S97T000998		Lower half	<2,140	<2,170	<2,160
S97T000995	193:7	Upper half	<2,080	<2,090	<2,090
S97T000999		Lower half	<2,040	<2,010	<2,030
S97T000996	193:8	Upper half	<1,920	<1,900	<1,910
S97T001000		Lower half	<2,030	<2,030	<2,030
S97T000997	193:9	Upper half	<1,970	<2,000	<1,990
S97T001001		Lower half	<1,960	<1,950	<1,960
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T001002	193:10	Lower half	<1,940	<1,990	<1,970
S97T001059	194:4	Lower half	<1,980	<1,990	<1,990
S97T001054	194:5	Upper half	<2,000	<1,990	<2,000
S97T001060		Lower half	<1,980	<2,060	<2,020
S97T001055	194:6	Upper half	<2,030	<2,030	<2,030
S97T001061		Lower half	<2,050	<2,060	<2,060
S97T001056	194:7	Upper half	<2,020	<2,010	<2,020
S97T001062		Lower half	<985	<963	<974
S97T001057	194:8	Upper half	<994	<1,000	<997
S97T001063		Lower half	<964	<978	<971
S97T001058	194:9	Upper half	<995	<984	<990
S97T001064		Lower half	<994	<994	<994
S97T001065	194:10	Lower half	<984	<992	<988
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T000881	193:4	Drainable liquid	22	23.6	22.8
S97T001079	194:4	Drainable liquid	<20.1	<20.1	<20.1

Table B2-37. Tank 241-AW-103 Analytical Results: Thallium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T000888	193:4	Lower half	<4,060	<4,070	<4,070
S97T000889	193:5	Upper half	<4,080	<4,080	<4,080
S97T000890		Lower half	<4,070	<4,050	<4,060
S97T000994	193:6	Upper half	<4,140	<4,140	<4,140
S97T000998		Lower half	<4,280	<4,340	<4,310
S97T000995	193:7	Upper half	<4,170	<4,180	<4,180
S97T000999		Lower half	<4,080	<4,020	<4,050
S97T000996	193:8	Upper half	<3,830	<3,800	<3,820
S97T001000		Lower half	<4,050	<4,050	<4,050
S97T000997	193:9	Upper half	<3,950	<4,000	<3,980
S97T001001		Lower half	<3,910	<3,890	<3,900
S97T001002	193:10	Lower half	<3,880	<3,970	<3,930
S97T001059	194:4	Lower half	<3,960	<3,980	<3,970
S97T001054	194:5	Upper half	<3,990	<3,980	<3,990
S97T001060		Lower half	<3,970	<4,120	<4,050
S97T001055	194:6	Upper half	<4,050	<4,050	<4,050
S97T001061		Lower half	<4,090	<4,120	<4,110
S97T001056	194:7	Upper half	<4,040	<4,030	<4,040
S97T001062		Lower half	<1,970	<1,930	<1,950
S97T001057	194:8	Upper half	<1,990	<2,000	<2,000
S97T001063		Lower half	<1,930	<1,960	<1,950
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T001058	194:9	Upper half	<1,990	<1,970	<1,980
S97T001064		Lower half	<1,990	<1,990	<1,990
S97T001065	194:10	Lower half	<1,970	<1,980	<1,980
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T000881	193:4	Drainable liquid	<40.2	<40.2	<40.2
S97T001079	194:4	Drainable liquid	<40.2	<40.2	<40.2

Table B2-38. Tank 241-AW-103 Analytical Results: Titanium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T000888	193:4	Lower half	<203	<203	<203
S97T000889	193:5	Upper half	<204	<204	<204
S97T000890		Lower half	<203	<203	<203
S97T000994	193:6	Upper half	<207	<207	<207
S97T000998		Lower half	<214	<217	<216
S97T000995	193:7	Upper half	<208	<209	<209
S97T000999		Lower half	<204	<201	<203
S97T000996	193:8	Upper half	<192	<190	<191
S97T001000		Lower half	<203	<203	<203
S97T000997	193:9	Upper half	<197	<200	<199
S97T001001		Lower half	<196	<195	<196
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T001002	193:10	Lower half	<194	<199	<197
S97T001059	194:4	Lower half	<198	<199	<199
S97T001054	194:5	Upper half	<200	<199	<200
S97T001060		Lower half	<198	<206	<202
S97T001055	194:6	Upper half	<203	<203	<203
S97T001061		Lower half	<205	<206	<206
S97T001056	194:7	Upper half	<202	<201	<202
S97T001062		Lower half	<98.5	<96.3	<97.4
S97T001057	194:8	Upper half	<99.4	<100	<99.7
S97T001063		Lower half	<96.4	<97.8	<97.1
S97T001058	194:9	Upper half	<99.5	<98.4	<99
S97T001064		Lower half	<99.4	<99.4	<99.4
S97T001065	194:10	Lower half	<98.4	<99.2	<98.8
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T000881	193:4	Drainable liquid	<2.01	<2.01	<2.01
S97T001079	194:4	Drainable liquid	<2.01	<2.01	<2.01

Table B2-39. Tank 241-AW-103 Analytical Results: Total Uranium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µg/g	µg/g	µg/g
S97T000888	193:4	Lower half	31,200	28,900	30,100
S97T000889	193:5	Upper half	44,100	43,100	43,600
S97T000890		Lower half	35,700	34,600	35,200
S97T000994	193:6	Upper half	34,000	33,500	33,800
S97T000998		Lower half	36,400	34,600	35,500
S97T000995	193:7	Upper half	29,500	29,200	29,400
S97T000999		Lower half	34,500	35,300	34,900
S97T000996	193:8	Upper half	37,200	36,600	36,900
S97T001000		Lower half	40,300	39,100	39,700
S97T000997	193:9	Upper half	46,500	54,800	50,700
S97T001001		Lower half	39,700	39,200	39,500
S97T001002	193:10	Lower half	<9710	<9930	<9820
S97T001059	194:4	Lower half	19,800	23,200	21,500
S97T001054	194:5	Upper half	43,200	41,100	42,200
S97T001060		Lower half	41,500	44,600	43,100
S97T001055	194:6	Upper half	35,700	34,300	35,000
S97T001061		Lower half	36,600	37,000	36,800
S97T001056	194:7	Upper half	32,600	32,900	32,800
S97T001062		Lower half	35,900	27,800	31,900[QC:e]
S97T001057	194:8	Upper half	37,100	37,200	37,200
S97T001063		Lower half	38,400	35,100	36,800
Solids: fusion			µg/g	µg/g	µg/g
S97T001058	194:9	Upper half	40,600	37,200	38,900
S97T001064		Lower half	41,400	43,300	42,400
S97T001065	194:10	Lower half	<4,920	<4,960	<4,940[QC:d]
Liquids			µg/mL	µg/mL	µg/mL
S97T000881	193:4	Drainable liquid	<100	<100	<100
S97T001079	194:4	Drainable liquid	<100	<100	<100

Table B2-40. Tank 241-AW-103 Analytical Results: Vanadium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**μg/g**	**μg/g**	**μg/g**
S97T000888	193:4	Lower half	1,030	1,020	1,030
S97T000889	193:5	Upper half	1,270	1,190	1,230
S97T000890		Lower half	<1,020	<1,010	<1,020
S97T000994	193:6	Upper half	<1,040	<1,030	<1,040
S97T000998		Lower half	<1,070	<1,090	<1,080
S97T000995	193:7	Upper half	<1,040	<1,040	<1,040
S97T000999		Lower half	<1,020	<1,010	<1,020
S97T000996	193:8	Upper half	<959	<949	<954
S97T001000		Lower half	<1,010	<1,010	<1,010
S97T000997	193:9	Upper half	<987	<1,000	<994
S97T001001		Lower half	<979	<973	<976
Solids: fusion			**μg/g**	**μg/g**	**μg/g**
S97T001002	193:10	Lower half	<971	<993	<982
S97T001059	194:4	Lower half	<991	<995	<993
S97T001054	194:5	Upper half	1,040	1,110	1,080
S97T001060		Lower half	1,080	1,120	1,100
S97T001055	194:6	Upper half	<1,010	<1,010	<1,010
S97T001061		Lower half	<1,020	<1,030	<1,030
S97T001056	194:7	Upper half	<1,010	<1,010	<1,010
S97T001062		Lower half	795	594	695[QC:e]
S97T001057	194:8	Upper half	758	803	781
S97T001063		Lower half	706	690	698
S97T001058	194:9	Upper half	694	679	687
S97T001064		Lower half	667	612	640
S97T001065	194:10	Lower half	<492	<496	<494
Liquids			**μg/mL**	**μg/mL**	**μg/mL**
S97T000881	193:4	Drainable liquid	<10.1	<10.1	<10.1
S97T001079	194:4	Drainable liquid	<10.1	<10.1	<10.1

Table B2-41. Tank 241-AW-103 Analytical Results: Zinc (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T000888	193:4	Lower half	<203	<203	<203
S97T000889	193:5	Upper half	<204	<204	<204
S97T000890		Lower half	<203	<203	<203
S97T000994	193:6	Upper half	<207	<207	<207
S97T000998		Lower half	<214	<217	<216
S97T000995	193:7	Upper half	<208	<209	<209
S97T000999		Lower half	<204	<201	<203
S97T000996	193:8	Upper half	<192	<190	<191
S97T001000		Lower half	<203	<203	<203
S97T000997	193:9	Upper half	<197	<200	<199
S97T001001		Lower half	<196	<195	<196
S97T001002	193:10	Lower half	<194	<199	<197
S97T001059	194:4	Lower half	<198	<199	<199
S97T001054	194:5	Upper half	<200	<199	<200
S97T001060		Lower half	200	<206	<203
S97T001055	194:6	Upper half	<203	<203	<203
S97T001061		Lower half	211	<206	<209
S97T001056	194:7	Upper half	<202	<201	<202
S97T001062		Lower half	406	265	336[QC:e]
S97T001057	194:8	Upper half	473	<100	<287[QC:e]
S97T001063		Lower half	<96.4	<97.8	<97.1
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T001058	194:9	Upper half	141	<98.4	<120[QC:e]
S97T001064		Lower half	<99.4	<99.4	<99.4
S97T001065	194:10	Lower half	<98.4	243	<171[QC:e]
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T000881	193:4	Drainable liquid	5.75	5.6	5.67
S97T001079	194:4	Drainable liquid	2.16	2.73	2.45[QC:e]

Table B2-42. Tank 241-AW-103 Analytical Results: Zirconium (ICP).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T000888	193:4	Lower half	1.39E+05	1.37E+05	1.38E+05
S97T000889	193:5	Upper half	1.68E+05	1.74E+05	1.71E+05
S97T000890		Lower half	1.42E+05	1.35E+05	1.39E+05
S97T000994	193:6	Upper half	1.24E+05	1.24E+05	1.24E+05
S97T000998		Lower half	1.37E+05	1.34E+05	1.36E+05[QC:c]
S97T000995	193:7	Upper half	1.14E+05	1.17E+05	1.16E+05
S97T000999		Lower half	1.30E+05	1.28E+05	1.29E+05
S97T000996	193:8	Upper half	1.23E+05	1.22E+05	1.23E+05
S97T001000		Lower half	1.13E+05	1.15E+05	1.14E+05
S97T000997	193:9	Upper half	1.14E+05	1.12E+05	1.13E+05
S97T001001		Lower half	1.16E+05	1.13E+05	1.15E+05
Solids: fusion			**µg/g**	**µg/g**	**µg/g**
S97T001002	193:10	Lower half	<194	<199	<197
S97T001059	194:4	Lower half	80,400	90,600	85,500
S97T001054	194:5	Upper half	1.59E+05	1.56E+05	1.58E+05
S97T001060		Lower half	1.59E+05	1.62E+05	1.61E+05
S97T001055	194:6	Upper half	1.18E+05	1.21E+05	1.20E+05
S97T001061		Lower half	1.32E+05	1.26E+05	1.29E+05
S97T001056	194:7	Upper half	1.20E+05	1.20E+05	1.20E+05
S97T001062		Lower half	1.35E+05	1.06E+05	1.21E+05[QC:e]
S97T001057	194:8	Upper half	1.28E+05	1.31E+05	1.30E+05
S97T001063		Lower half	1.25E+05	1.15E+05	1.20E+05
S97T001058	194:9	Upper half	1.20E+05	1.17E+05	1.19E+05
S97T001064		Lower half	1.10E+05	1.09E+05	1.10E+05
S97T001065	194:10	Lower half	9,370	10,800	10,100
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T000881	193:4	Drainable liquid	<2.01	<2.01	<2.01
S97T001079	194:4	Drainable liquid	<2.01	<2.01	<2.01

Table B2-43. Tank 241-AW-103 Analytical Results: Bromide (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			µg/g	µg/g	µg/g
S97T000891	193:4	Lower half	<1,080	<1,090	<1,080
S97T000892	193:5	Upper half	<1,050	<1,050	<1,050
S97T000893		Lower half	<959	<967	<963
S97T001003	193:6	Upper half	<995	<1,000	<997
S97T001007		Lower half	<1,020	<1,020	<1,020
S97T001004	193:7	Upper half	<1,050	<1,060	<1,060
S97T001008		Lower half	<918	<939	<929
S97T001005	193:8	Upper half	<904	<935	<920
S97T001009		Lower half	<952	<973	<962
S97T001006	193:9	Upper half	<1,240	<1,250	<1,250
S97T001010		Lower half	<1,240	<1,230	<1,230
S97T001011	193:10	Lower half	<1,230	<1,240	<1,240
S97T001071	194:4	Lower half	<524	<516	<520
S97T001066	194:5	Upper half	<526	<517	<521
S97T001072		Lower half	<1,000	<1,010	<1,010
S97T001067	194:6	Upper half	<1,310	<1,290	<1,300
S97T001073		Lower half	<1,260	<1,300	<1,280
S97T001068	194:7	Upper half	<1,240	<1,250	<1,240
S97T001074		Lower half	<977	<981	<979
S97T001069	194:8	Upper half	<946	<939	<943
S97T001075		Lower half	<1,000	<987	<994
Solids: water digest			µg/g	µg/g	µg/g
S97T001070	194:9	Upper half	<977	<953	<965
S97T001076		Lower half	<875	<869	<872
S97T001077	194:10	Lower half	<979	<983	<981
Liquids			µg/mL	µg/mL	µg/mL
S97T000881	193:4	Drainable liquid	<518	<518	<518
S97T001079	194:4	Drainable liquid	<518	<518	<518

Table B2-44. Tank 241-AW-103 Analytical Results: Chloride (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			**µg/g**	**µg/g**	**µg/g**
S97T000891	193:4	Lower half	<147	<148	<147
S97T000892	193:5	Upper half	<142	155	<149
S97T000893		Lower half	154	155	155
S97T001003	193:6	Upper half	1,310	1,380	1,350
S97T001007		Lower half	638	711	674
S97T001004	193:7	Upper half	403	511	457[QC:e]
S97T001008		Lower half	627	494	560[QC:e]
S97T001005	193:8	Upper half	826	968	897
S97T001009		Lower half	579	597	588
S97T001006	193:9	Upper half	966	1,000	983
S97T001010		Lower half	1,070	1,230	1,150
Solids: water digest			**µg/g**	**µg/g**	**µg/g**
S97T001011	193:10	Lower half	1,660	1,680	1,670
S97T001071	194:4	Lower half	154	215	184[QC:e]
S97T001066	194:5	Upper half	245	181	213[QC:e]
S97T001072		Lower half	308	340	324
S97T001067	194:6	Upper half	421	418	420
S97T001073		Lower half	389	397	393
S97T001068	194:7	Upper half	692	733	713
S97T001074		Lower half	618	483	550[QC:e]
S97T001069	194:8	Upper half	979	900	939
S97T001075		Lower half	1,310	1,110	1,210
S97T001070	194:9	Upper half	824	721	772
S97T001076		Lower half	3,150	3,260	3,210
S97T001077	194:10	Lower half	2,540	2,490	2,520
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T000881	193:4	Drainable liquid	119	136	127
S97T001079	194:4	Drainable liquid	147	150	148

Table B2-45. Tank 241-AW-103 Analytical Results: Fluoride (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			**µg/g**	**µg/g**	**µg/g**
S97T000891	193:4	Lower half	59,400	67,400	63,400
S97T000892	193:5	Upper half	30,500	31,400	30,900
S97T000893		Lower half	43,900	44,600	44,200
S97T001003	193:6	Upper half	61,700	61,500	61,600
S97T001007		Lower half	39,900	39,000	39,400
S97T001004	193:7	Upper half	82,900	83,900	83,400
S97T001008		Lower half	67,000	66,000	66,500
S97T001005	193:8	Upper half	68,300	70,800	69,600
S97T001009		Lower half	65,600	63,800	64,700[QC:c]
S97T001006	193:9	Upper half	86,900	87,200	87,100
S97T001010		Lower half	62,300	63,700	63,000
S97T001011	193:10	Lower half	5,770	5,810	5,790
S97T001071	194:4	Lower half	36,900	36,100	36,500
S97T001066	194:5	Upper half	36,000	35,200	35,600
S97T001072		Lower half	28,000	28,700	28,300
S97T001067	194:6	Upper half	72,500	70,200	71,400
S97T001073		Lower half	46,600	48,100	47,400[QC:c]
S97T001068	194:7	Upper half	67,500	66,800	67,100
S97T001074		Lower half	81,200	71,200	76,200
S97T001069	194:8	Upper half	61,400	64,900	63,100
S97T001075		Lower half	53,200	61,700	57,400
Solids: water digest			**µg/g**	**µg/g**	**µg/g**
S97T001070	194:9	Upper half	66,000	63,700	64,800
S97T001076		Lower half	6,290	6,230	6,260
S97T001077	194:10	Lower half	1.14E+05	1.13E+05	1.14E+05
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T000881	193:4	Drainable liquid	17,400	17,900	17,600
S97T001079	194:4	Drainable liquid	16,100	15,900	16,000

Table B2-46. Tank 241-AW-103 Analytical Results: Nitrate (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			**µg/g**	**µg/g**	**µg/g**
S97T000891	193:4	Lower half	3,520	3,620	3,570
S97T000892	193:5	Upper half	2,980	3,510	3,240
S97T000893		Lower half	4,220	4,020	4,120
S97T001003	193:6	Upper half	6,940	7,530	7,230
S97T001007		Lower half	9,450	10,400	9,920
S97T001004	193:7	Upper half	13,800	13,700	13,800
S97T001008		Lower half	19,000	18,900	18,900
S97T001005	193:8	Upper half	46,600	46,800	46,700
S97T001009		Lower half	27,800	29,000	28,400
S97T001006	193:9	Upper half	68,800	69,000	68,900
S97T001010		Lower half	110,000	109,000	110,000
Solids: water digest			**µg/g**	**µg/g**	**µg/g**
S97T001011	193:10	Lower half	201,000	202,000	202,000
S97T001071	194:4	Lower half	3,130	3,010	3,070
S97T001066	194:5	Upper half	3,170	3,120	3,150
S97T001072		Lower half	4,800	4,860	4,830
S97T001067	194:6	Upper half	6,300	6,090	6,200
S97T001073		Lower half	8,450	9,350	8,900
S97T001068	194:7	Upper half	12,500	12,500	12,500
S97T001074		Lower half	15,600	15,100	15,300
S97T001069	194:8	Upper half	26,100	28,500	27,300
S97T001075		Lower half	37,700	41,900	39,800
S97T001070	194:9	Upper half	7,940	8,320	8,130
S97T001076		Lower half	1.24-E+05	1.24-E+05	1.24-E+05
S97T001077	194:10	Lower half	1.04-E+05	1.05-E+05	1.04-E+05
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T000881	193:4	Drainable liquid	4,090	4,270	4,180
S97T001079	194:4	Drainable liquid	4,240	4,290	4,260

Table B2-47. Tank 241-AW-103 Analytical Results: Nitrite (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			µg/g	µg/g	µg/g
S97T000891	193:4	Lower half	1,630	1,580	1,610
S97T000892	193:5	Upper half	2,130	2,350	2,240
S97T000893		Lower half	2,780	2,770	2,770
S97T001003	193:6	Upper half	4,100	4,420	4,260
S97T001007		Lower half	5,540	5,320	5,430
S97T001004	193:7	Upper half	6,900	7,110	7,000
S97T001008		Lower half	8,600	8,460	8,530
S97T001005	193:8	Upper half	18,200	18,800	18,500
S97T001009		Lower half	11,800	12,100	12,000
S97T001006	193:9	Upper half	23,000	23,000	23,000
S97T001010		Lower half	31,600	31,900	31,800
S97T001011	193:10	Lower half	35,200	35,000	35,100
S97T001071	194:4	Lower half	1,560	1,550	1,550
S97T001066	194:5	Upper half	2,250	2,210	2,230
S97T001072		Lower half	3,230	3,300	3,270
S97T001067	194:6	Upper half	4,840	4,770	4,800
S97T001073		Lower half	6,310	6,400	6,350
S97T001068	194:7	Upper half	8,440	8,670	8,560
S97T001074		Lower half	9,570	9,440	9,500
S97T001069	194:8	Upper half	16,000	17,000	16,500
S97T001075		Lower half	21,000	23,600	22,300
Solids: water digest			µg/g	µg/g	µg/g
S97T001070	194:9	Upper half	5,460	5,330	5,400
S97T001076		Lower half	53,000	52,700	52,800
S97T001077	194:10	Lower half	44,800	44,900	44,900
Liquids			µg/mL	µg/mL	µg/mL
S97T000881	193:4	Drainable liquid	1,840	1,760	1,800
S97T001079	194:4	Drainable liquid	1,760	1,750	1,750

Table B2-48. Tank 241-AW-103 Analytical Results: Phosphate (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			**µg/g**	**µg/g**	**µg/g**
S97T000891	193:4	Lower half	<1,040	<1,050	<1,040
S97T000892	193:5	Upper half	<1,000	<1,000	<1,000
S97T000893		Lower half	<921	<928	<924
S97T001003	193:6	Upper half	<2,350	<2,370	<2,360
S97T001007		Lower half	<2,420	<2,410	<2,410
S97T001004	193:7	Upper half	<2,490	<2,500	<2,500
S97T001008		Lower half	<882	<902	<892
S97T001005	193:8	Upper half	<868	<897	<883
S97T001009		Lower half	<914	<934	<924
S97T001006	193:9	Upper half	<1,190	<1,200	<1,200
S97T001010		Lower half	<1,190	<1,180	<1,180
Solids: water digest			**µg/g**	**µg/g**	**µg/g**
S97T001011	193:10	Lower half	36,900	36,800	36,800
S97T001071	194:4	Lower half	<503	<495	<499
S97T001066	194:5	Upper half	<505	<496	<500
S97T001072		Lower half	<961	<966	<964
S97T001067	194:6	Upper half	<1,250	<1,240	<1,250
S97T001073		Lower half	<1,210	<1,240	<1,230
S97T001068	194:7	Upper half	<1,190	<1,200	<1,200
S97T001074		Lower half	<938	<942	<940
S97T001069	194:8	Upper half	<908	<901	<905
S97T001075		Lower half	<960	<948	<954
S97T001070	194:9	Upper half	<2,310	<2,250	<2,280
S97T001076		Lower half	7,180	7,010	7,100
S97T001077	194:10	Lower half	<2,310	<2,320	<2,320
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T000881	193:4	Drainable liquid	<497	<497	<497
S97T001079	194:4	Drainable liquid	<497	<497	<497

Table B2-49. Tank 241-AW-103 Analytical Results: Sulfate (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			**µg/g**	**µg/g**	**µg/g**
S97T000891	193:4	Lower half	<1,190	<1,200	<1,200
S97T000892	193:5	Upper half	<1,150	<1,150	<1,150
S97T000893		Lower half	<1,060	<1,070	<1,060
S97T001003	193:6	Upper half	<2,710	<2,720	<2,710
S97T001007		Lower half	3,820	2,800	3,310[QC:e]
S97T001004	193:7	Upper half	3,210	<2,880	<3,050
S97T001008		Lower half	<1,010	<1,040	<1,030
S97T001005	193:8	Upper half	<998	1,120	<1,060
S97T001009		Lower half	<1,050	1,630	<1,340[QC:e]
S97T001006	193:9	Upper half	<1,370	1,480	<1,430
S97T001010		Lower half	1,840	1,940	1,890
S97T001011	193:10	Lower half	2,020	2,360	2,190
S97T001071	194:4	Lower half	786	836	811
S97T001066	194:5	Upper half	851	<571	<711[QC:e]
S97T001072		Lower half	<1,110	1,150	<1,130
S97T001067	194:6	Upper half	1,650	1,680	1,670
S97T001073		Lower half	1,480	1,440	1,460
S97T001068	194:7	Upper half	2,170	2,210	2,190
S97T001074		Lower half	<1,080	<1,080	<1,080
S97T001069	194:8	Upper half	<1,040	<1,040	<1,040
S97T001075		Lower half	<1,100	<1,090	<1,100
Solids: water digest			**µg/g**	**µg/g**	**µg/g**
S97T001070	194:9	Upper half	<2,660	<2,590	<2,620
S97T001076		Lower half	3,150	3,310	3,230
S97T001077	194:10	Lower half	3,640	3,360	3,500
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T000881	193:4	Drainable liquid	<572	<571	<571
S97T001079	194:4	Drainable liquid	783	762	773

Table B2-50. Tank 241-AW-103 Analytical Results: Oxalate (IC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: water digest			**µg/g**	**µg/g**	**µg/g**
S97T000891	193:4	Lower half	<907	<916	<911
S97T000892	193:5	Upper half	<878	<879	<879
S97T000893		Lower half	<805	<812	<809
S97T001003	193:6	Upper half	<2,060	<2,070	<2,060
S97T001007		Lower half	<2,120	<2,110	<2,110
S97T001004	193:7	Upper half	<2,180	<2,190	<2,180
S97T001008		Lower half	<771	<789	<780
S97T001005	193:8	Upper half	<760	<785	<772
S97T001009		Lower half	<799	<817	<808
S97T001006	193:9	Upper half	<1,040	<1,050	<1,050
S97T001010		Lower half	1,300	1,300	1,300
Solids: water digest			**µg/g**	**µg/g**	**µg/g**
S97T001011	193:10	Lower half	28,900	28,500	28,700
S97T001071	194:4	Lower half	<440	<433	<437
S97T001066	194:5	Upper half	<442	<434	<438
S97T001072		Lower half	<841	<846	<844
S97T001067	194:6	Upper half	<1,100	<1,080	<1,090
S97T001073		Lower half	<1,060	<1,090	<1,070
S97T001068	194:7	Upper half	<1,040	<1,050	<1,050
S97T001074		Lower half	<821	<824	<822
S97T001069	194:8	Upper half	<795	<788	<791
S97T001075		Lower half	<840	<829	<835
S97T001070	194:9	Upper half	<2,020	<1,970	<2,000
S97T001076		Lower half	14,700	14,300	14,500
S97T001077	194:10	Lower half	<2,030	<2,030	<2,030
Liquids			**µg/mL**	**µg/mL**	**µg/mL**
S97T000881	193:4	Drainable liquid	<435	<435	<435
S97T001079	194:4	Drainable liquid	<435	<435	<435

Table B2-51. Tank 241-AW-103 Analytical Results: Bulk Density.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids			**g/mL**	**g/mL**	**g/mL**
S97T000873	193:4	Lower half	1.39	N/A	1.39
S97T000876	193:5	Lower half	1.36	N/A	1.36
S97T000971	193:6	Lower half	1.4	N/A	1.4
S97T000972	193:7	Lower half	1.52	N/A	1.52
S97T000973	193:8	Lower half	1.52	N/A	1.52
S97T000974	193:9	Lower half	1.65	N/A	1.65
S97T000975	193:10	Lower half	1.73	N/A	1.73
S97T001024	194:5	Lower half	1.27	N/A	1.27
S97T001025	194:6	Lower half	1.3	N/A	1.3
S97T001026	194:7	Lower half	1.47	N/A	1.47
S97T001027	194:8	Lower half	1.5	N/A	1.5
S97T001028	194:9	Lower half	1.71	N/A	1.71
S97T001029	194:10	Lower half	1.54	N/A	1.54

Table B2-52. Tank 241-AW-103 Analytical Results: Exotherm - Transition 1 (DSC).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids			**J/g**	**J/g**	**J/g**
S97T000878	193:4	Lower half	1020	922	973[1]
S97T000983	193:9	Lower half	27.9	11.1	19.5[QC:e]
S97T000984	193:10	Lower half	258	212	235
S97T001041	194:10	Lower half	261	333	297

Note:

[1]Value was not reproduced on either of two reruns.

Table B2-53. Tank 241-AW-103 Analytical Results: Percent Water (TGA)

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids			%	%	%
S97T000878	193:4	Lower half	60.7	62.5	61.6
S97T000878RR1		Lower half	60.9	57.6	59.3
S97T000879	193:5	Upper half	64.9	64.4	64.7
S97T000880		Lower half	63.3	61.9	62.6
S97T000976	193:6	Upper half	64.9	64.9	64.9
S97T000980		Lower half	63.4	65.6	64.5
S97T000977	193:7	Upper half	60.3	58	59.2
S97T000981		Lower half	51.9	55.5	53.7
S97T000978	193:8	Upper half	46.5	46.8	46.7
S97T000982		Lower half	52	54.5	53.3
S97T000979	193:9	Upper half	38	39.7	38.9
S97T000983		Lower half	40.7	32.4	36.5
S97T000984	193:10	Lower half	47.1	43.5	45.3
S97T001035	194:4	Lower half	74.2	73.4	73.8
S97T001030	194:5	Upper half	66.8	71.6	69.2
S97T001036		Lower half	66.3	67.4	66.9
S97T001031	194:6	Upper half	57	61	59
S97T001037		Lower half	64.6	65.1	64.9
S97T001032	194:7	Upper half	60.8	59.6	60.2
S97T001038		Lower half	48.1	47.9	48
S97T001033	194:8	Upper half	51.7	53.7	52.7
S97T001039		Lower half	50.8	52.4	51.6
Solids			%	%	%
S97T001034	194:9	Upper half	35.3	39.6	37.5
S97T001040		Lower half	38.2	38.4	38.3
S97T001041	194:10	Lower half	45.6	44.5	45
Liquids			%	%	%
S97T000881	193:4	Drainable liquid	92.5	92.3	92.4
S97T001079	194:4	Drainable liquid	92	92.3	92.2

Table B2-54. Tank 241-AW-103 Analytical Results: Percent Water.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids			%	%	%
S97T000878	193:4	Lower half	59.4	60.3	59.9
S97T000879	193:5	Upper half	63	63.5	63.3
S97T000880		Lower half	64.4	64.2	64.3
S97T000976	193:6	Upper half	60.4	62.2	61.3
S97T000980		Lower half	63.3	66.7	65
S97T000977	193:7	Upper half	57.7	58.1	57.9
S97T000981		Lower half	54.9	53.2	54
S97T000978	193:8	Upper half	47.5	46.5	47
S97T000982		Lower half	52.5	52.6	52.5
S97T000979	193:9	Upper half	36.4	37.9	37.1
S97T000983		Lower half	38.3	38.4	38.3
S97T000984	193:10	Lower half	37.4	34.2	35.8
S97T001035	194:4	Lower half	74.9	75.5	75.2
S97T001030	194:5	Upper half	62.4	62.9	62.6
S97T001036		Lower half	65.4	65.3	65.3
S97T001031	194:6	Upper half	60.2	60.2	60.2
S97T001037		Lower half	63.2	63.1	63.2
S97T001032	194:7	Upper half	58.4	56.7	57.5
S97T001038		Lower half	35.9	26.6	31.2[QC:e]
S97T001033	194:8	Upper half	51.1	48.8	50
S97T001039		Lower half	47.6	46.3	46.9
S97T001034	194:9	Upper half	37.1	36.1	36.6
S97T001040		Lower half	36.6	32.5	34.5
S97T001041	194:10	Lower half	42	44.1	43

Table B2-55. Tank 241-AW-103 Analytical Results: Specific Gravity.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			unitless	unitless	unitless
S97T000881	193:4	Drainable liquid	1.04	0.96	1
S97T001079	194:4	Drainable liquid	1.03	1.03	1.03

Table B2-56. Tank 241-AW-103 Analytical Results: Total Alpha (Alpha Radiation).

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Liquids			µCi/mL	µCi/mL	µCi/mL
S97T000881	193:4	Drainable liquid	<8.58E-05	<1.96E-04	<1.41E-04
S97T001079	194:4	Drainable liquid	<7.41E-04	<9.04E-04	<8.23E-04

Table B2-57. Tank 241-AW-103 Analytical Results: Total Alpha.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids: fusion			µCi/g	µCi/g	µCi/g
S97T000888	193:4	Lower half	0.14	0.149	0.145
S97T000890	193:5	Lower half	1.03	1.17	1.1
S97T000998	193:6	Lower half	0.649	0.731	0.69
S97T000999	193:7	Lower half	0.203	0.184	0.194
S97T001000	193:8	Lower half	0.4	0.41	0.405[QC:e]
S97T001001	193:9	Lower half	0.569	0.543	0.556
S97T001002	193:10	Lower half	0.0911	0.089	0.09
S97T001059	194:4	Lower half	0.0456	0.058	0.0518[QC:e]
S97T001060	194:5	Lower half	0.721	0.792	0.757[QC:e]
S97T001061	194:6	Lower half	0.487	0.528	0.508
S97T001062	194:7	Lower half	0.258	0.194	0.226[QC:e]
S97T001063	194:8	Lower half	0.496	0.445	0.471
S97T001064	194:9	Lower half	0.0713	0.0713	0.0713
S97T001065	194:10	Lower half	0.0832	0.119	0.101[QC:e]

Table B2-58. Tank 241-AW-103 Analytical Results: Total Inorganic Carbon.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Triplicate	Mean
Solids			μg/g	μg/g	μg/g	μg/g
S97T000878	193:4	Lower half	892	903		898
S97T000983	193:9	Lower half	1,240	1,950	1,770	1,650[QC:e]
S97T000984	193:10	Lower half	1,350	1,340		1,350
S97T001041	194:10	Lower half	1,530	1,520		1,530

Table B2-59. Tank 241-AW-103 Analytical Results: Total Organic Carbon.

Sample Number	Sample Location	Sample Portion	Result	Duplicate	Mean
Solids			μg/g	μg/g	μg/g
S97T000878	193:4	Lower half	247	195	221[QC:e]
S97T000983	193:9	Lower half	2,220	2,340	2,280
S97T000984	193:10	Lower half	10,100	10,000	10,050
S97T001041	194:10	Lower half	8,300	8,850	8,575

B2.3 1994 GRAB SAMPLING EVENT

On September 29, 1994, three liquid grab samples were taken from riser 1A of tank 241-AW-103 (Dodd 1994). Samples R6492, R6493, and R6494 were taken 5.90 m (233 in.), 4.72 m (186 in.), and 3.45 m (136 in.) from the tank bottom, respectively. The liquid grab samples were taken from riser 1A. There were no problems associated with obtaining the samples.

B2.3.1 Sample Handling (1994)

The liquid samples taken on September 29, 1994, from tank 241-AW-103 for determining waste compatibility, were sent from the tank farm and received by the 222-S Laboratory on September 30, 1994. The waste compatibility samples were supernatant and were described as a clear, yellow liquid with an estimated solids content of <2 volume percent.

B2.3.2 Sample Analysis (1994)

The waste compatibility samples were prepared for analysis in accordance with waste compatibility tank characterization plans. The analyses of the waste compatibility samples were performed in accordance with Bratzel (1994). The samples were analyzed for metals, anions, radionuclides, and TOC/TIC. Because the samples were liquids without solids, no special sample treatment or sample splitting was necessary. The supernatant was analyzed directly or diluted using the appropriate acid or water sample preparation.

B2.3.3 Analytical Results (1994)

Table B2-60 summaries the results for the 1994 sampling event.

Table B2-60. Double-Shell Tank 241-AW-103 Concentrations for Major Analytes and Analytes of Concern. (2 sheets)

Physical Properties	Liquid Results
Specific gravity	1.00
Percent water	92.0
pH	13.0
Chemical Constituents	**Liquid Concentration (μg/g)**
Metals	
Al	41.6
Fe	<2.05
Na	19,600
Ions	
Cl^-	135
F^-	17,400
NO_3^-	3,510
NO_2^-	1,220
OH^-	3,200
PO_4^{3-}	58.0
SO_4^{2-}	56.3

Table B2-60. Double-Shell Tank 241-AW-103 Concentrations for Major Analytes and Analytes of Concern. (2 sheets)

Radionuclides	**μCi/g**
$^{89/90}Sr$	2.20E-04
^{134}Cs	0.145
^{137}Cs	20.6
$^{239/240}Pu$	<1.16E-05
^{241}Am	<1.67E-04
Carbon	**(μg/g)**
TOC	935
TIC	921

B2.4 1989 PUSH MODE CORE SAMPLING EVENT

A core sample was obtained in January 1989 from riser 16B (Tingey et al. 1990). Ten 19-inch segments were originally taken from the tank. Segments 1 and 2 were liquid; segments 3 through 10 contained solids. Two additional segments were from a resampling of segments 4 and 5 because of uncertainties in the representativeness of the solids in the original samples (Tingey et al. 1990). The core sample segments were identified by the segment number assigned in the field.

Difficulties occurred during core sampling for segments 3, 4, and 5. The material recovered for segments 3 and 5 was less than 1 in.. For segment 3, it appears that the bottom valve did not seal correctly on the sampler. For segment 5, the piston in the sampler malfunctioned before the bottom valve was closed. Segment 4 contained the expected amount of solids, but the piston was not properly engaged by the equipment and was not pulled the length of the sampler until after the sampler had descended its maximum depth. A uniform segment could not have been collected; instead, a sampling of a narrow area around the sampler opening occurred (Weiss 1990).

The 1989 core sample was taken to determine the success of a PUREX process test in which the NCRW was sent to a different waste tank than the rinse waste from the decladding process. The test was to determine the effect of this separation on the transuranic content of the waste. However, the difficulties that occurred with segments 3, 4, and 5 made it impossible to make any conclusion concerning the success of the process test. The core sample was also analyzed for process development information.

B2.4.1 Sample Handling (1989)

The core sample was sent to the Westinghouse Hanford Company Process Chemistry Laboratories where it was broken down for analysis at the 222-S Laboratory. The sample was also processed for shipment to the 325 Laboratory for analysis by Pacific Northwest Laboratory.

Segments 1 and 2 were liquid. A portion of each of these segments was sent to the Pacific Northwest Laboratory; and the remainder of segments 1 and 2 were composited for analysis by the 222-S Laboratory. Segment 3 did not contain enough material to be analyzed. Segments 4, 4R, and 5R were divided into quarter segments, and each quarter segment was centrifuged. The liquid from the quarter segments was composited as follows. Within segments 4 and 5R, the liquids from quarter segments 1 and 2 were composited and the liquids from quarter segments 3 and 4 were composited, for a total of four samples. Segment 4R had material in the first and fourth quarters. After centrifugation, the solids and liquids were composited into two samples. A subsample from each composited centrifuged solid (quarter segments of 4, 4R, and 5) was sent to the Pacific Northwest Laboratory. Because insufficient liquid was obtained from the quarter segments to allow analysis at both the 222-S Laboratory and the Pacific Northwest Laboratory, all liquid composite samples were shipped to the Pacific Northwest Laboratory. Except for the portion of segment 8 removed and shipped to the Pacific Northwest Laboratory, all portions of segments 6 through 10 were composited. A subsample of the composite was sent to the Pacific Northwest Laboratory.

B2.4.2 Sample Analysis (1989)

The 1989 core samples were analyzed in accordance with a letter of instruction issued by Wanner (1989). The letter of instruction details the core sample breakdown and analytical requirements. The upper segments (4 and 5) were divided into quarter segments to try to detect the effects of the PUREX process radionuclides. The lower segments (6 to10) were composited because they were being analyzed for process development information, and the retrieval process would be provided a composited feed for treatment. For additional information on analytical methods, refer toDe Lorenzo et al. (1994).

Results from analyses of the 1989 core sample performed by the 222-S Laboratory are described in Weiss (1990) and shown in Table B2-61. At the 222-S Laboratory, metals were determined by inductively coupled plasma/optical emission spectroscopy. An oxalic acid or water leach digestion was used to prepare the samples for analysis. In the case of some metals and radionuclides, the oxalic acid leach was followed by a nitric-hydrofluoric acid leach. The oxalic acid was used as a primary dissolution agent based on previous experience dissolving zirconium-containing solids associated with cladding type wastes. It also allowed analysis of anions, such as nitrate, which is not feasible with strong nitric acid. Anions were determined on a water leach of the solids by ion chromatography. No TOC or cyanide data was obtained in the 1989 sampling and analysis event.

B2.4.3 Analytical Results (1989)

The chemical and radiological characteristics of sludge in tank 241-AW-103 are shown in terms of the specific concentrations of metals, ions, and radionuclides from the 1989 core sampling event.

Table B2-61. Tank AW-103 Sludge Composition Data Summary of 1989. (2 sheets)

Analyte	Number of Samples	Percent Nondetect Samples	Minimum Observed Value	Maximum Observed Value	Mean	Relative Standard Deviation
Metals		%	µg/g	µg/g	µg/g	%
Ag	8	0	293	828	471	4.73
Al	11	0	1,500	8,500	6,200	3.12
B	10	0	187	5,040	2,120	3.91
Ba	11	0	140	727	385	6.75
Bi	10	0	276	711	377	9.51
Ca	11	0	227	1,660	881	5.50
Ce	11	9	587	2,940	1,130	8.78
Cr	11	0	193	2,270	1,550	11.7
Cu	11	0	18.2	50.0	33.5	9.79
Fe	11	0	536	1,050	805	10.2
K	11	0	449	22,000	11,200	6.15
La	11	0	150	4,140	842	13.2
Mg	11	0	55.0	2,210	603	13.2
Mn	11	0	70.0	869	264	7.88
Mo	11	0	110	400	248	11.7
Na	11	0	33,400	197,000	138,000	19.4
Nd	11	9	62.1	1,330	243	16.7
Ni	11	0	63.4	310	175	11.7
P	11	9	313	1,220	922	7.41
Sn	9	0	376	1,850	725	9.73
Ti	11	0	16.2	50.0	31.5	6.64
U	11	0	7,850	16,500	9,380	3.40
Zn	7	0	12.1	160	82.2	15.6
Zr	11	0	58,500	237,000	102,000	7.91

Table B2-61. Tank AW-103 Sludge Composition Data Summary of 1989. (2 sheets)

Analyte	Number of Samples	Percent Nondetect Samples	Minimum Observed Value	Maximum Observed Value	Mean	Relative Standard Deviation
Ions		%	μg/g	μg/g	μg/g	%
CO_3^{-2}	10	0	5,600	18,600	7,150	7.30
F^-	10	0	14,900	193,500	59,700	11.4
OH^-	10	0	4,500	12,700	10,700	5.24
NO_3^-	10	0	2,600	147,000	101,000	4.77
Radionuclide		%	μCi/g	μCi/g	μCi/g	%
^{241}Am	11	0	0.0388	0.855	0.122	23.2
^{144}CePr	10	0	3.03	221	40.4	16.4
^{60}Co	8	0	0.13	0.51	0.212	5.64
^{134}Cs	10	0	0.16	0.88	0.309	2.98
^{137}Cs	10	0	22.5	85.6	67.7	0.47
^{155}Eu	8	0	0.020	0.68	0.147	11.6
$^{239/240}$Pu	11	0	0.37	2.05	0.689	7.84
^{106}RuRh	10	0	7.6	95	22.3	15.6
$^{89/90}$Sr	10	0	2.97	27.1	11.2	23.1

B3.0 ASSESSMENT OF CHARACTERIZATION RESULTS

This section discusses the overall quality and consistency of the 1997 core sampling results for tank 241-AW-103 and provides the results of an analytical-based inventory calculation.

This section also evaluates sampling and analysis factors that may impact data interpretation. These factors are used to assess overall data quality and consistency and to identify limitations in data use.

B3.1 FIELD OBSERVATIONS

Sample recovery overall, was good for both cores 193 and 194 taken at risers 10A and 12A respectively. Both cores coincided relatively well with the expected distribution of the tank waste. On core 194, a 3 in. limit was imposed, indicating that the core sampling was halted 3 in. before contacting the bottom of the tank.

B3.2 QUALITY CONTROL ASSESSMENT

The usual QC assessment includes an evaluation of the appropriate standard recoveries, spike recoveries, duplicate analyses, and blanks that are performed in conjunction with the chemical analyses. All pertinent QC tests were conducted on the 1997 core samples, allowing a full assessment regarding the accuracy and precision of the data. The SAP (Benar 1997) established specific criteria for all analytes. Sample and duplicate pairs with one or more QC results outside the specified criteria were identified by footnotes in the data summary tables.

The standard and spike recovery results provide an estimate of analysis accuracy. If a standard or spike recovery is above or below the given criterion, the analytical results may be biased high or low, respectively. The precision is estimated by the relative percent difference (RPD), which is defined as the absolute value of the difference between the primary and duplicate samples, divided by their mean, times 100.

The DSC analysis was performed in duplicate on direct sub-samples. Two samples exceeded the DSC notification limit of 480 J/g, dry weight basis (see Section 2.1.1) as stated in the safety screening DQO (Dukelow et al. 1995). Relative percent differences greater than 30 percent (precision requirement for solid samples) were reported for 1 of 27 subsamples submitted for analysis. The nonhomogeneous material and small sample size required for this analysis made it difficult to obtain reproducible results. The standard recoveries for this analysis were within the required limits.

The TGA analysis was performed in duplicate on direct subsamples. The standard recoveries and RPDs for this analysis were within the required limits. The gravimetric percent water analyses were performed in duplicate on direct subsamples. The results from the gravimetric percent water show the amount of moisture present in the samples is consistent with the results from the TGA.

Bulk density was performed on the solid subsamples as required by the SAP (Benar 1997). Bulk density analyses were not performed on core 194, segment 4, because of insufficient sample recovery. Specific gravity analyses were performed on the liquid subsamples.

The standard recoveries, RPDs, and spike recoveries for samples analyzed by IC and ICP were within the required limits.

Total organic carbon analyses by persulfate oxidation/coulometry were performed in duplicate on direct subsamples. The standard recoveries and spike recoveries for the TOC analyses were within the required limits.

Total alpha analyses were performed in duplicate on direct subsamples for liquids. All liquid and solid total alpha results were below the total alpha activity action limit. High RPDs (>20 percent) were reported for 3 of 17 subsamples. The sample results were near the detection limit which decreased the precision of the analyses. No reruns were requested because of the low alpha activity in the samples. Spike recoveries outside of the required range (75 to 125 percent) were reported for two subsamples. The spike recoveries were within the laboratory statistical control limits for the QC standard; no reruns were requested. The standard recoveries for this analysis were within the required limits.

B3.3 DATA CONSISTENCY CHECKS

Comparing different analytical methods is helpful in assessing the consistency and quality of the data. For tank 241-AW-103, the analysis returned "less than" values on those sets that could be compared, that is, phosphorous and sulfur by ICP compared to phosphate and sulfate by IC. Also, isotope specific radionuclide analyses were not performed. However, a comparison of weight percent water by TGA to the weight percent water by gravimetry for the same sample locations was done. In addition, mass and charge balances were calculated to help assess the overall data consistency.

B3.3.1 Comparison of Results from Different Analytical Methods

The percent water as determined by TGA for the same sample locations was compared to percent water by gravimetric methods as shown in Table B3-1. The RPD was determined to be 3.12 percent.

Table B3-1. Comparison of Percent Water Mean Values from TGA and Percent Solids Analysis.

Sample Number	Sample Location	Sample Portion	Percent	
			TGA Percent Water (mean)	Solids Percent Water (mean)
S97T000878	193:4	Lower half	61.6	59.8
S97T000879	193:5	Upper half	64.7	63.3
S97T000880		Lower half	62.6	64.3
S97T000976	193:6	Upper half	64.9	61.3
S97T000980		Lower half	64.5	65
S97T000977	193:7	Upper half	59.2	57.9
S97T000981		Lower half	53.7	54
S97T000978	193:8	Upper half	46.7	47
S97T000982		Lower half	53.3	52.5
S97T000979	193:9	Upper half	38.9	37.1
S97T000983		Lower half	36.5	38.3
S97T000984	193:10	Lower half	45.3	35.8
S97T001035	194:4	Lower half	73.8	75.2
S97T0001030	194:5	Upper half	69.2	62.6
S97T0001036		Lower half	66.9	65.3
S97T0001031	194:6	Upper half	59	60.2
S97T0001037		Lower half	64.9	63.2
S97T0001032	194:7	Upper half	60.2	57.5
S97T0001033	194:8	Upper half	52.7	50
S97T0001039		Lower half	51.6	46.9
S97T0001034	194:9	Upper half	37.5	36.6
S97T0001040		Lower half	38.3	34.5
S97T0001041	194:10	Lower half	45	43
Sum			1,281	1,241
RPD			3.12%	

B3.3.2 Mass and Charge Balance

The principal objective in performing mass and charge balances is to determine whether measurements are consistent. In calculating the balances, only the analytes listed in Section B2.0, which were detected at a concentration of 1,000 μg/g or greater, were considered.

Except for sodium, all cations listed in Table B3-2 and B3-4 were assumed to be in their most common hydroxide or oxide form, and the concentrations of the assumed species were calculated stoichiometrically. Because precipitates are neutral species, all positive charge was attributed to the sodium cation. The anions listed in Table B3-3 and B3-5 were assumed to be present as sodium salts and were expected to balance the positive charge exhibited by the cations. Sulfate, as determined by IC, is assumed to be completely water soluble and appears only in the anion mass and charge calculations.

B3.3.2.1 Solids Mass and Charge Balance. The mass balance was calculated from the formula below. The factor 0.0001 is the conversion factor from micrograms per gram to weight percent.

Mass balance = % Water + 0.0001 x {total aAnalyte concentration}

= % Water + 0.0001 x {Na + UO_3 + $ZrO(OH)_2$ + F + NO_3 + NO_2 + SiO_3 + SO_4}

The total analyte concentrations calculated from the above equation is 463,000 μg/g. The mean weight percent water (obtained from the gravimetric analyses reported in Table B3-4) is 52.7 percent or 527,000 μg/g. The mass balance resulting from adding the percent water to the total analyte concentration is 101 percent (see Table B3-6).

Table B3-2. Cation Mass and Charge Data (Solids).

Analyte	Concentration (μg/g)	Assumed Species	Concentration of Assumed Species (μg/g)	Charge (μeq/g)
Na	1.38E+05	Na	1.38E+05	6,000
U	3.19E04	UO_3	3.83E+04	0
Zr	1.08E+05	$ZrO(OH)_2$	1.67E+05	0
Total			3.43E+05	6,000

Table B3-3. Anion Mass and Charge Data (Solids).

(μg/g)	Concentration (μg/g)	Assumed Species	Concentration of Assumed Species (μg/g)	Charge (μeq/g)
F	5.6E+04	F	5.6E+04	-2,947
NO_3	4.09E+04	NO_3	4.09E+04	-659
NO_2	1.41E+04	NO_2	1.41E+04	-307
Si	2.78E+03	SiO_3^{-2}	7.53E+03	-198
SO_4	1.76E+03	SO_4^{-2}	1.76E+03	-37
Total			1.2E+05	-4,148

The following equations demonstrate the derivation of total cations and total anions; the charge balance is the ratio of these two values.

Total cations (μeq/g) = $[Na^+]/23.0 + [UO_3]/286 + [ZrO(OH)_2]/141 = 6{,}000$ μeq/g

Total anions (μeq/g) = $[F^-]/19.0 + [NO_3^-]/62.0 + [NO_2]/46 + [SiO_3^{-2}]/38 + [SO_4^{-2}] = 4{,}418$ μeq/g

The initial charge balance obtained by dividing the sum of the positive charge by the sum of the negative charge was 1.45. This result suggests there is a substantial quantity of unmeasured hydroxide present.

In summary, the above calculations yield a reasonable mass balance (close to 100 percent). However, the charge balance values should be close to 1.00. Inclusion of hydroxide is used to balance the charge. The amount required is 1,582 * 17 = 26,900 μg/g. This assumption brings the charge balance to 1.00 and the mass balance to 1.01.

B3.3.2.2 Liquid Mass and Charge Balance.

Mass balance = % Water + 0.0001 x {total analyte concentration}

= % Water + 0.0001 x $\{Na + K + F + NO_3 + NO_2\}$

The total analyte concentrations calculated from the above equation is 61,700 μg/g. The mean weight percent water (obtained from the gravimetric analyses reported in Table B3-4) is 92.3 percent or 923,000 μg/g. The mass balance resulting from adding the percent water to the total analyte concentration is 99 percent (see Table B3-6).

Table B3-4. Cation Mass and Charge Data (Liquid).

Analyte	Concentration (μg/g)	Assumed Species	Concentration of Assumed Species (μg/g)	Charge (μeq/g)
K	1.43E+04	K	1.43E+04	366
Na	2.46E+04	Na	2.46E+04	1,070
Totals			3.89E04	1,436

Table B3-5. Anion Mass and Charge Data.

Analyte	Concentration (μg/g)	Assumed Species	Concentration of Assumed Species (μg/g)	Charge (μeq/g)
F	1.68E+04	F	1.68E+04	-884
NO_3	4.22E+03	NO_3	4.22E+03	-68
NO_2	1.78E+03	NO_2	1.78E+03	-39
Totals			2.28E+04	-991

The following equations demonstrate the derivation of total cations and total anions; the charge balance is the ratio of these two values.

Total cations (μeq/g) = $[Na^+]/23.0 + [K]/39 = 1436\ \mu eq/g$

Total anions (μeq/g) = $[F^-]/19.0 + [NO_3^-]/62.0 + [NO_2]/46 + = 991\ \mu eq/g$

The charge balance obtained by dividing the sum of the positive charge by the sum of the negative charge was 1.45, again suggesting the presence of hydroxide.

In summary, the above calculations yield a reasonable mass balance (close to 100 percent). However, the charge balance values should be close to 1.00. Inclusion of hydroxide values is used to balance the charge. The amount required is 445 * 17 = 7,565 μg/g. This assumption brings the charge balance to 1.00 and the mass balance to 0.99.

Table B3-6. Mass and Charge Balance Totals.

Totals	Concentrations (μg/g)	Charge (μeq/g)
Solids		
Total from Table B3-1 (cations)	3.43E+05	6,000
Total from Table B3-2 (anions)	1.2E+05	-4,148
Hydroxide added for charge balance	0.27E+05	-1,852
Water	5.27E+05	N/A
Total	10.17E+05	0
Liquids		
Total from Table B3-3 (cations)	3.89E+04	1436
Total from Table B3-4 (anions)	2.28E+04	-991
Hydroxide added for charge balance	0.76+04	-445
Water	9.23E+05	N/A
Total	9.923E+05	0

B3.4 MEAN CONCENTRATIONS AND CONFIDENCE INTERVALS

B3.4.1 Solid Data

A nested analysis of variance model was fit to the core segment data. Mean values and 95 percent confidence intervals on the mean were determined from the nested analysis of variance using the S-Plus model (Statistical Science 1993). Four variance components were used in the calculations. The variance components represent concentration differences between risers, segments, laboratory samples, and analytical replicates. The model is:

$$Y_{ijk} = \mu + R_i + S_{ij} + L_{ijk} + A_{ijkm},$$

$$i=1,2,\ldots,a;\ j=1,2,\ldots,b_i;\ k=1,2,\ldots,c_{ij};m=1,2,\ldots,n_{ijk}$$

where

Y_{ijkm} = concentration from the m^{th} analytical result of the k^{th} sample of the j^{th} segment of the i^{th} riser

μ = the mean

R_i	=	the effect of the i^{th} riser
S_{ij}	=	the effect of the j^{th} segment from the i^{th} riser
L_{ijk}	=	the effect of the k^{th} sample from the j^{th} segment of the i^{th} riser
A_{ijkm}	=	the analytical error
a	=	the number of risers
b_i	=	the number of segments from the i^{th} riser
c_{ij}	=	the number of samples from the j^{th} segment of the i^{th} riser
n_{ijk}	=	the number of analytical results from the ijk^{th} sample

The variables R_i, S_{ij}, and L_{ijk} are random effects. These variables, as well as A_{ijkm}, are assumed to be uncorrelated and normally distributed with means zero and variances $\sigma^2(R)$, $\sigma^2(S)$, $\sigma^2(L)$ and $\sigma^2(A)$, respectively.

The restricted maximum likelihood method was used to estimate the mean concentration and standard deviation of the mean for all analytes that had 50 percent or more of their reported values greater than the detection limit. The mean value and standard deviation of the mean were used to calculate the 95 percent confidence intervals. Table B3-7 gives the mean, degrees of freedom, and confidence interval for each constituent.

Some analytes had results below the detection limit. In these cases, the value of the detection limit was used for non-etected results. For analytes with a majority of results below the detection limit, a simple average is all that is reported.

The lower and upper limits, LL(95%) and UL(95%), of a two-sided 95 percent confidence interval on the mean were calculated using the following equation:

$$LL(95\%) = \hat{\mu} - t_{(df,\,0.025)} \times \hat{\sigma}(\hat{\mu}),$$
$$UL(95\%) = \hat{\mu} + t_{(df,\,0.025)} \times \hat{\sigma}(\hat{\mu}).$$

In this equation, $\hat{\mu}$ is the restricted maximum likelihood estimate of the mean concentration, $\hat{\sigma}(\hat{\mu})$ is the restricted maximum likelihood estimate of the standard deviation of the mean, and $t_{(df,\,0.025)}$ is the quantile from Student's t distribution with *df* degrees of freedom. The degrees of freedom equals the number of risers with data minus one. In cases where the lower limit of the confidence interval was negative, it is reported as zero.

Table B3-7. 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Solid Segment Data. (2 sheets)

Analyte	Method	$\hat{\mu}$	df	LL	UL	Units
Aluminum[1]	ICP:F	<6.06E+03	n/a	n/a	n/a	μg/g
Antimony[1]	ICP:F	<1.31E+03	n/a	n/a	n/a	μg/g
Arsenic[1]	ICP:F	<1.76E+03	n/a	n/a	n/a	μg/g
Barium[1]	ICP:F	<8.81E+02	n/a	n/a	n/a	μg/g
Beryllium[1]	ICP:F	9.93E+01	1	0.00E+00	2.36E+02	μg/g
Bismuth[1]	ICP:F	<1.76E+03	n/a	n/a	n/a	μg/g
Boron[1]	ICP:F	<1.14E+03	n/a	n/a	n/a	μg/g
Bromide[1]	IC:W	<1.01E+03	n/a	n/a	n/a	μg/g
Bulk density	Bulk	1.49E+00	1	9.75E-01	2.00E+00	g/mL
Cadmium[1]	ICP:F	<8.84E+01	n/a	n/a	n/a	μg/g
Calcium[1]	ICP:F	<1.76E+03	n/a	n/a	n/a	μg/g
Cerium[1]	ICP:F	<1.76E+03	n/a	n/a	n/a	μg/g
Chloride[1]	IC:W	8.58E+02	1	0.00E+00	3.09E+03	μg/g
Chromium[1]	ICP:F	<1.79E+03	n/a	n/a	n/a	μg/g
Cobalt[1]	ICP:F	<3.52E+02	n/a	n/a	n/a	μg/g
Copper[1]	ICP:F	<1.76E+02	n/a	n/a	n/a	μg/g
Fluoride	IC:W	5.60E+04	1	0.00E+00	1.35E+05	μg/g
Gross alpha	Alpha:F	3.83E-01	1	0.00E+00	1.45E+00	μCi/g
Iron[1]	ICP:F	<8.98E+02	n/a	n/a	n/a	μg/g
Lanthanum[1]	ICP:F	<9.53E+02	n/a	n/a	n/a	μg/g
Lead[1]	ICP:F	<1.76E+03	n/a	n/a	n/a	μg/g
Lithium[1]	ICP:F	<1.76E+02	n/a	n/a	n/a	μg/g
Magnesium[1]	ICP:F	<1.76E+03	n/a	n/a	n/a	μg/g
Manganese[1]	ICP:F	<1.78E+02	n/a	n/a	n/a	μg/g
Molybdenum[1]	ICP:F	<8.81E+02	n/a	n/a	n/a	μg/g
Neodymium[1]	ICP:F	<1.76E+03	n/a	n/a	n/a	μg/g
Nitrate	IC:W	4.09E+04	1	0.00E+00	2.21E+05	μg/g
Nitrite	IC:W	1.41E+04	1	0.00E+00	5.69E+04	μg/g
Oxalate[1]	IC:W	<2.84E+03	n/a	n/a	n/a	μg/g
Percent water	TGA	5.51E+01	1	1.76E+01	9.25E+01	%
Percent water	Percent solids	5.27E+01	1	1.15E+01	9.39E+01	%

Table B3-7. 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Solid Segment Data. (2 sheets)

Analyte	Method	$\hat{\mu}$	df	LL	UL	Units
Phosphate[1]	IC:W	<3.01E+03	n/a	n/a	n/a	μg/g
Phosphorus[1]	ICP:F	<3.91E+03	n/a	n/a	n/a	μg/g
Samarium[1]	ICP:F	<1.76E+03	n/a	n/a	n/a	μg/g
Silicon[1]	ICP:F	2.78E+03	1	0.00E+00	1.51E+04	μg/g
Silver[1]	ICP:F	5.46E+02	1	0.00E+00	1.20E+03	μg/g
Sodium	ICP:F	1.38E+05	1	0.00E+00	3.18E+05	μg/g
Strontium[1]	ICP:F	<1.76E+02	n/a	n/a	n/a	μg/g
Sulfate[1]	IC:W	1.76E+03	1	0.00E+00	4.55E+03	μg/g
Sulfur[1]	ICP:F	<1.76E+03	n/a	n/a	n/a	μg/g
Thallium[1]	ICP:F	<3.52E+03	n/a	n/a	n/a	μg/g
Titanium[1]	ICP:F	<1.76E+02	n/a	n/a	n/a	μg/g
TOC[1]	TIC/TOC	5.09E+03	1	0.00E+00	3.64+04	μg/g
Uranium[1]	ICP:F	3.19E+04	1	0.00E+00	7.15E+04	μg/g
Vanadium[1]	ICP:F	<9.40E+02	n/a	n/a	n/a	μg/g
Zinc[1]	ICP:F	<1.98E+02	n/a	n/a	n/a	μg/g
Zirconium[1]	ICP:F	1.08E+05	1	0.00E+00	2.67E+05	μg/g

Note:
[1]A "less than" value was used in the calculation

B3.4.2. Liquid Data

The model fit to the liquid data was a nested ANOVA model. The model determined the mean value and 95 percent confidence interval, for each constituent Two variance components were used in the calculations. The variance components represent concentration differences between samples taken from different riser and between analytical replicates. The model is:

$$Y_{ijk} = \mu + R_i + A_{ij},$$

$$i=1,2,\ldots,a;\ j=1,2,\ldots,n_i;$$

where

Y_{ijk} = concentration from the k^{th} analytical result of the j^{th} sample from the i^{th} segment

μ = the mean

R_i = the effect of the i^{th} riser

A_{ij} = the analytical error

a = the number of segments

n_i = the number of analytical results from the i^{th} riser

The variable R_i is a random effect. This variable, along with A_{ij}, is assumed to be uncorrelated and normally distributed with means zero and variances $\sigma^2(R)$, and $\sigma^2(A)$ respectively. The *df* associated with the standard deviation of the mean is the number of risers with data minus one. Table B3-8 gives the mean, degrees of freedom, and confidence interval for each constituent.

Table B3-8. 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Liquid Data. (3 sheets)

Analyte	Method	μ	df	LL	UL	Units
Aluminum	ICP	6.46E+01	1	0.00E+00	2.61E+02	μg/mL
Antimony[1]	ICP	<1.21E+01	n/a	n/a	n/a	μg/mL
Arsenic[1]	ICP	<2.01E+01	n/a	n/a	n/a	μg/mL
Barium[1]	ICP	<1.01E+01	n/a	n/a	n/a	μg/mL
Beryllium[1]	ICP	<1.01E+00	n/a	n/a	n/a	μg/mL
Bismuth[1]	ICP	<2.01E+01	n/a	n/a	n/a	μg/mL
Boron[1]	ICP	<1.01E+01	n/a	n/a	n/a	μg/mL
Bromide[1]	IC	<5.18E+02	n/a	n/a	n/a	μg/mL
Cadmium[1]	ICP	<1.01E+00	n/a	n/a	n/a	μg/mL
Calcium[1]	ICP	<2.01E+01	n/a	n/a	n/a	μg/mL
Cerium[1]	ICP	<2.01E+01	n/a	n/a	n/a	μg/mL
Chloride	IC	1.38E+02	1	5.36E+00	2.70E+02	μg/mL
Chromium	ICP	2.53E+01	1	1.51E+01	3.55E+01	μg/mL

Table B3-8. 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Liquid Data. (3 sheets)

Analyte	Method	$\hat{\mu}$	df	LL	UL	Units
Cobalt	ICP	7.22E+00	1	5.71E+00	8.72E+00	μg/mL
Copper[1]	ICP	<2.01E+00	n/a	n/a	n/a	μg/mL
Fluoride	IC	1.68E+04	1	6.36E+03	2.73E+04	μg/mL
Iron[1]	ICP	<1.01E+01	n/a	n/a	n/a	μg/mL
Lanthanum[1]	ICP	<1.01E+01	n/a	n/a	n/a	μg/mL
Lead[1]	ICP	<2.01E+01	n/a	n/a	n/a	μg/mL
Lithium[1]	ICP	<2.01E+00	n/a	n/a	n/a	μg/mL
Magnesium[1]	ICP	<2.01E+01	n/a	n/a	n/a	μg/mL
Manganese[1]	ICP	<2.01E+00	n/a	n/a	n/a	μg/mL
Molybdenum[1]	ICP	<1.01E+01	n/a	n/a	n/a	μg/mL
Neodymium[1]	ICP	<2.01E+01	n/a	n/a	n/a	μg/mL
Nickel[1]	ICP	<4.02E+00	n/a	n/a	n/a	μg/mL
Nitrate	IC	4.22E+03	1	3.66E+03	4.79E+03	μg/mL
Nitrite	IC	1.78E+03	1	1.49E+03	2.06E+03	μg/mL
Oxalate[1]	IC	<4.35E+02	n/a	n/a	n/a	μg/mL
Percent water	DSC/ TGA	9.23E+01	1	9.06E+01	9.39E+01	%
Phosphate[1]	IC	<4.97E+02	n/a	n/a	n/a	μg/mL
Phosphorus[1]	ICP	<4.02E+01	n/a	n/a	n/a	μg/mL
Potassium	ICP	1.43E+04	1	1.11E+04	1.74E+04	μg/mL
Samarium[1]	ICP	<2.01E+01	n/a	n/a	n/a	μg/mL
Silicon	ICP	2.49E+02	1	1.78E+02	3.19E+02	μg/mL
Silver[1]	ICP	<2.01E+00	n/a	n/a	n/a	μg/mL
Sodium	ICP	2.46E+04	1	2.00E+04	2.92E+04	μg/mL
Specific gravity	SpG	1.02E+00	1	7.76E-01	1.25E+00	unitless
Strontium[1]	ICP	<2.01E+00	n/a	n/a	n/a	μg/mL
Sulfate[1]	IC	6.72E+02	1	0.00E+00	1.95E+03	μg/mL
Sulfur[1]	ICP	2.14E+01	1	4.30E+00	3.86E+01	μg/mL
Thallium[1]	ICP	<4.02E+01	n/a	n/a	n/a	μg/mL
Titanium[1]	ICP	<2.01E+00	n/a	n/a	n/a	μg/mL
Uranium[1]	ICP	<1.00E+02	n/a	n/a	n/a	μg/mL

Table B3-8. 95 Percent Two-Sided Confidence Interval for the Mean Concentration for Liquid Data. (3 sheets)

Analyte	Method	$\hat{\mu}$	df	LL	UL	Units
Vanadium[1]	ICP	<1.01E+01	n/a	n/a	n/a	μg/mL
Zinc	ICP	4.06E+00	1	0.00E+00	2.46E+01	μg/mL
Zirconium[1]	ICP	<2.01E+00	n/a	n/a	n/a	μg/mL

Note:

[1]A "less than" value was used in the calculation

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APPENDIX C

STATISTICAL ANALYSIS FOR ISSUE RESOLUTION

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APPENDIX C

STATISTICAL ANALYSIS FOR ISSUE RESOLUTION

Appendix C documents the results of the analyses and statistical and numerical manipulations required by the DQOs applicable for tank 241-AW-103. The analyses required for tank 241-AW-103 are reported as follows:

- **Section C1.0**: Statistical analysis and numerical manipulations supporting the safety screening DQO (Dukelow et al. 1995).
- **Section C2.0**: Appendix C References.

C1.0 STATISTICS FOR THE SAFETY SCREENING DATA QUALITY OBJECTIVE

The safety screening DQO (Dukelow et al. 1995) defines decision limits in terms of one-sided 95 percent confidence intervals. The safety screening DQO limits are 41 μCi/g for gross alpha and 480 J/g for DSC.

Confidence intervals were calculated for the mean value from each laboratory sample. The data used in the computations was from the data package of the 1997 core sampling event. Table C1-1 has the gross alpha results, and Table C1-2 has the DSC results.

The upper limit (UL) of a one-sided 95 percent confidence interval on the mean is

$$\hat{\mu} + t_{(df,0.05)}\,\hat{\sigma}_{\hat{\mu}}.$$

In this equation, $\hat{\mu}$ is the arithmetic mean of the data, $\hat{\sigma}_{\hat{\mu}}$ is the estimate of the standard deviation of the mean, and $t_{(df,0.05)}$ is the quantile from Student's t distribution with *df* degrees of freedom. The degrees of freedom equals the number of samples minus one.

For sample numbers with at least one value above the detection limit, the UL of a 95 percent confidence interval is given in Table C1-1. Each confidence interval can be used to make the following statement. If the UL is less than 41 μCi/g (61.5 μCi/mL for drainable liquid), reject the null hypothesis that the alpha is greater than or equal to 41 μCi/g (61.5 μCi/mL for drainable liquid) at the 0.05 level of significance.

For the solid segment data, all 28 gross alpha results were above the detection limit. The UL closest to the threshold was 1.54 μCi/g, for core 193, segment 5. This is well below the limit of 41 μCi/g. All four gross alpha results from the liquid samples were below the detection limit.

Table C1-1. 95 Percent Upper Confidence Limits for Gross Alpha.

Laboratory Sample Identification	Description	$\hat{\mu}$	df	UL	Units
S97T000888F	Core 193, segment 4, lower half	0.1450	1	0.1730	μCi/g
S97T000890F	Core 193, segment 5, lower half	1.1000	1	1.5400	μCi/g
S97T000998F	Core 193, segment 6, lower half	0.6900	1	0.9490	μCi/g
S97T000999F	Core 193, segment 7, lower half	0.1940	1	0.2530	μCi/g
S97T001000F	Core 193, segment 8, lower half	0.4050	1	0.4370	μCi/g
S97T001001F	Core 193, segment 9, lower half	0.5560	1	0.6380	μCi/g
S97T001002F	Core 193, segment 10 lower half	0.0900	1	0.0967	μCi/g
S97T001059F	Core 194, segment 4, lower half	0.0518	1	0.0909	μCi/g
S97T001060F	Core 194, segment 5, lower half	0.7560	1	0.9810	μCi/g
S97T001061F	Core 194, segment 6, lower half	0.5080	1	0.6370	μCi/g
S97T001062F	Core 194, segment 7, lower half	0.2260	1	0.4280	μCi/g
S97T001063F	Core 194, segment 8, lower half	0.4700	1	0.6320	μCi/g
S97T001064F	Core 194, segment 9, lower half	0.0713	1	0.0713	μCi/g
S97T001065F	Core 194, segment 10 lower half	0.1010	1	0.2140	μCi/g

No exotherms were observed in 48 of 56 DSC primary/duplicate results. Ninety-five percent upper confidence limits are given for each sample number with at least one exothermic data point. All results are expressed on a dry weight basis. Each confidence interval can be used to make the following statement. If the UL is less than 480 J/g, reject the null hypothesis that DSC is greater than or equal to 480 J/g at the 0.05 level of significance. The maximum upper limit to a 95 percent confidence interval on the mean for DSC was 1.87E+03 J/g dry weight, for core 193, segment 4. This is above the threshold limit of 480 J/g.

Table C1-2. 95 Percent Upper Confidence Limits for Differential Scanning Calorimetry.

Laboratory Sample Identification	Description	$\hat{\mu}$	df	UL	Units
S97T000878[1]	Core 193, segment 4, lower half	8.19E+02	5	1.87E+03	J/g dry weight
S97T000983	Core 193, segment 9, lower half	3.07E+01	1	1.14E+02	J/g dry weight
S97T000984	Core 193, segment 10, lower half	4.30E+02	1	6.98E+02	J/g dry weight
S97T001041	Core 194, segment 10, lower half	5.41E+02	1	9.55E+02	J/g dry weight

Note:

[1]The value of zero was used for an endothermic reaction.

C2.0 APPENDIX C REFERENCES

Dukelow, G. T., J. W. Hunt, H. Babad, and J. E Meacham, 1995, *Tank Safety Screening Data Quality Objective*, WHC-SD-WM-SP-004, Rev. 2, Westinghouse Hanford Company, Richland, Washington.

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APPENDIX D

EVALUATION TO ESTABLISH THE BEST-BASIS INVENTORY FOR DOUBLE-SHELL TANK 241-AW-103

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APPENDIX D

EVALUATION TO ESTABLISH THE BEST-BASIS INVENTORY FOR DOUBLE-SHELL TANK 241-AW-103

An effort is underway to provide waste inventory estimates that will serve as standard characterization source terms for various waste management activities (Hodgson and LeClair 1996). As part of this effort, an evaluation of available information for double-shell tank 241-AW-103 was performed, and a best-basis inventory was established. This work, detailed in the following sections, follows the methodology that was established by the standard inventory task.

D1.0 CHEMICAL INFORMATION SOURCES

The available composition information for tank 241-AW-103 used in this report is as follows.

- Analytical results for two push core samples taken May 1997 (see Appendix B), based on segments 4 through 10 (1 through 3 were not recovered).

- The 1994 grab sampling event which provides results for the supernatant. Tables B3-7 and B3-8 summarizes the results from the statistical analysis of data from both sample events.

- Analytical results (Table B2-61) for the 1989 core sampling event.

- Teats (1982) provides characterization data on the double-shell slurry feed heel in tank 241-AW-103.

- Schofield (1991) provides tank content estimates based on a reconciliation of flowsheet records, process tests, and the 1989 core sample.

- The HDW model document (Agnew et al. 1997a) provides tank content estimates derived from the HDW model in terms of component concentrations and inventories.

D2.0 COMPARISON OF COMPONENT INVENTORY VALUES

Previous best-basis and HDW model inventories (Agnew et al. 1997a), are compared in Tables D2-1 and D2-2. The chemical species are reported without charge designation according to the best-basis inventory convention. The previous best basis does not include the results of push core samples taken in May 1997.

Table D2-1. Hanford Defined Waste Model and Previous Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-AW-103. (2 sheets)

Analyte	HDW Inventory Estimate[1] (kg)	Previous Best-Basis Inventory[2] (kg)
Al	40.0	12,100
Bi	0.222	0.222
Ca	5540	1,730
Cl	345	77.7
Cr	20.9	3,040
F	142,000	127,000
Fe	28,000	1,580
Hg	580	580
K	17,600	33,500
La	0.00128	1,650
Mn	13.1	517
Na	184,000	282,000
Ni	4.50	343
NO_2	1,030	702
NO_3	49,400	200,000
OH	121,000	168,000
Pb	0.609	<157
P as PO_4	267	33.4
Si	2.12	31,900
S as SO_4	36.8	32.4
Sr	0	39.2
TIC as CO_3	8,570	16,600
TOC	33.5	538
U_{TOTAL}	13,900	18,400

Table D2-1. Hanford Defined Waste Model and Previous Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-AW-103. (2 sheets)

Analyte	HDW Inventory Estimate[1] (kg)	Previous Best-Basis Inventory[2] (kg)
Zr	116,000	167,000
H_2O (wt%)	75.5	n/r
Density (kg/L)	1.17	n/r

Note:
HDW = Hanford Defined Waste
n/r = Not reported

[1]Agnew et al. (1997a)
[2]Based on 1989 core samples (LMHC 1998).

Table D2-2. Hanford Defined Waste Model and Previous Best-Basis Inventory Estimates for Radioactive Components in Tank 241-AW-103.

Analyte	HDW[1] Inventory Estimate (Ci)	Previous Best Basis Inventory[2] (kg)
^{90}Sr	10,000	19,600
^{137}Cs	11,900	132,000

Notes:
[1] Agnew et al. (1997a), decayed to January 1, 1994.
[2](LMHC 1998), decayed to January 1, 1994.

D3.0 COMPONENT INVENTORY EVALUATION

D3.1 WASTE HISTORY TANK 241-AW-103

Tank 241-AW-103 first received DSSF in 1980 from 242-A Evaporator Campaigns 80-8, 80-10, and 81-1. The DSSF from campaigns 80-10 and 81-1 were initially sent to other tanks where solids were allowed to settle before being transferred to tank 241-AW-103. After most of the DSSF supernatant was pumped out of tank 241-AW-103, leaving a DSSF heel, tank 241-AW-103 began receiving (NCRW from the PUREX Plant. Tank 241-AW-103 continued to receive transfers of NCRW from 1983 through 1988. Recently, tank 241-AW-103 has received small amounts of miscellaneous PUREX wastes with low solids content (Agnew et al. 1997b).

D3.2 CONTRIBUTING WASTE TYPES

The HDW model (Agnew et al. 1997a) estimates that 2,080 kL (550 kgal) of zirconium cladding waste solids (CWZr2) was sent to the two NCRW waste tanks (241-AW-103 and 241-AW-105). Table D3-3 shows the composition of this material which is often referred to as NCRW. The *PUREX Flowsheet Reprocessing N Reactor Fuels* (RHO 1985) and fuel discharge records indicate that 17,400 kL of NCRW was transferred (3,920 metric ton of uranium processed at 4,427 L/metric ton of uranium) to tanks 241-AW-103 and 241-AW-105. Schofield (1991) indicates that the waste volume may have been slightly higher (18,700 kL).

The Anderson (1990) report, written in 1979, was subsequently updated. The only entry for tank 241-AW-103 shows it was "in service 7-30-80" and contained 959 kgal of DSSF at the end of 1980.

D3.3 ASSUMPTIONS USED

The evaluation below provides an engineering assessment of tank 241-AW-103 contents. The following assumptions and observations were made:

- The tank waste total volume is 1,939 kL (512 kgal), the solids volume is 1,374 kL (363 kgal), and the supernate volume is 564 kL (149 kgal) based on Hanlon (1998).

- Sludge analyte concentrations are from 1997 core samples and 1989 sludge samples; a density of 1.49 was used to calculate inventories.

- Supernatant analyte concentrations are from 1997 core samples and 1994 grab samples.

D3.3.1 Volume Ratio Double-Shell Slurry: Neutralized Cladding Removal Waste in the Sludge

The HDW model (Agnew et al. 1997a) does not predict that any DSSF remained in tank 241-AW-103. A comparison of the component concentrations in the lower segments of the 1997 core sample with those in the upper segments suggests otherwise. Tables B2-7, B2-17, B2-29, B2-48, B2-34, B2-46, and B2-47 of this TCR indicate the concentrations of Al, Cr, PO_4, Na, NO_3, and NO_2 are higher in the composite of segments 9 and 10 than in other segments. These components usually comprise the bulk of DSSF.

One way to estimate the volume of the DSSF heel in tank 241-AW-103 is to estimate the number of segments in the composite of segments 6 through 10 that represent DSSF. This can be done as follows: use the component concentrations of the DSSF that entered the tank, (assuming the volume of the composite not occupied by DSSF has the same concentrations as NCRW segments 4 and 5) and adjust the relative proportions of both layers until the calculated concentrations approach the reported average analytical concentrations for the entire composite.

For example, the DSSF concentration for Al in Table D3-3 is 1.47*M* and the analytical average result for segments 4 and 5 is 0.128*M*. The average Al concentration for the composite of segments 6 through 10 is 0.367*M*. Assuming that one of the five segments in the composite represents DSSF, the calculation would be:

$$\frac{(1\ \text{seg})(1.47M) + (4\ \text{seg})(0.128M)}{(5\ \text{seg})} = 0.396M$$

which is eight percent higher than the reported value of 0.367*M*.

The best results are achieved when the DSSF heel is assumed to be equivalent to 0.90 segments, or

(0.90 segment)*(19 in./segment)*(2,750 gal/in.)*(3.785 L/gal) = 178,000 L.

The calculated composite concentrations are compared with the analytical composite concentrations in Table D3-1.

Table D3-1. Calculated and Reported Analytical Concentrations for Tank 241-AW-103 Partial Core Composite.[1]

Analyte	Calculated Composite (*M*)[2] for Segments 6-10	Analytical Composite (*M*)
Al	0.37	0.367
OH	0.99	1.01
NO_3	0.64	3.23
CO_3	0.26	0.142
PO_4	0.036	0.052

Notes:

[1]Based on the assumption that the DSSF heel occupies 178,000 liters of the sludge volume (0.90 fraction of a core segment)

[2]Calculated from 1989 mean composite data in Appendix B using a density of 1.43 g/mL (Table B2-61).

D3.3.2 Layer Analysis

An evaluation was made on selected analytes to determine the appropriateness of overall averaging versus layer averaging. The analytes selected were aluminum and zirconium because of their large spacial bias. Table D3-2 shows the layer analysis results.

Table D3-2. Layer Analysis Results.

	Basis	Segments 4-9 Average ($\mu g/g$)	Segment 10 Average ($\mu g/g$)	Segments 4-10 Average ($\mu g/g$)
Aluminum	Table B2-7	1,774	46,500	5,501
Zirconium	Table B2-41	126,800	5,050	116,713
Density	Table B2-51	1.46	1.64	1.49

For aluminum the layer and average methods yield:

layer

1,774 * 1.46 * (11 half segments) + 46,500 * 1.64 * (1 half segment) = 104,750

overall

5,501 * 1.49 * (12 half segments) = 98,358 which is 6.0 percent below the layer model.

For zirconium the layer and average methods yield:

layer

126,864 * 1.46 * (11 half segments) + 5,050 * 1.64 * (1 half segment) = 2,037,436

overall

116,713 * 1.49 * (12 half segments) = 2,086,828 which is 2.4 percent above the layer model.

Based on these small differences, the average model is used to represent the tank and make calculations throughout this section.

D3.4 BASIS FOR THE ENGINEERING EVALUATION

D3.4.1 Solids

Table D3-3 compares the composition of waste found in tank 241-AW-103 core samples (see Appendix B3) with NCRW composition estimates (Schofield 1991), HDW model estimates from Agnew et al. (1997a), and the DSSF composition for the 242-A Evaporator Campaign 80-8 (Teats 1982). This comparison shows variations between models and actual compositions.

Table D3-3. Comparison of Tank 241-AW-103 Solids Concentration of Technical Flowsheet, Los Alamos National Laboratory Hanford Defined Waste Streams, and Core Samples. (2 sheets)

Analyte	Flowsheet NCRW[1] (*M*)	HDW Model CWZr2[2] (*M*)	80-8 Evaporator Campaign DSSF[3] (*M*)	1989 Core Sample (*M*)	1997 Core Sample (*M*)
Al	n/r	0	1.47	0.367	0.328
NO_3	0.024	0.332	3.19	3.23	2.33
NO_2	0.011	0.00919	2.12	n/r	n/r
Fe	0.00206 [4]	0.364	n/r	0.021	n/r
Cr	7.74E-04 [4]	0	n/r	0.043	n/r
Ni	3.62E-04 [4]	0	n/r	0.0043	n/r
Zr	0.18	0.927	n/r	n/r	1.60
Na	1.634	5.50	n/r	n/r	8.58
Ca	n/r	0.0949	n/r	0.0315	n/r
OH	0.72	5.10	2.57	1.01	0.90
CO_3	n/r	0.0949	0.318	0.142	0.170
PO_4	n/r	0	0.115	n/r	n/r
F	1.36	5.29	n/r	n/r	4.49
Cl	n/r	0.00397	n/r	n/r	n/r
Hg	n/r	0.00210	n/r	n/r	n/r
K	0.47	0.191	n/r	n/r	0.411
NH_3	n/r	0.655	n/r	n/r	n/r
TOC	n/r	0	12.2 g/L	n/r	n/r

Table D3-3. Comparison of Tank 241-AW-103 Solids Concentration of Technical Flowsheet, Los Alamos National Laboratory Hanford Defined Waste Streams, and Core Samples. (2 sheets)

Analyte	Flowsheet NCRW[1] (*M*)	HDW Model CWZr2[2] (*M*)	80-8 Evaporator Campaign DSSF[3] (*M*)	1989 Core Sample (*M*)	1997 Core Sample (*M*)
U	n/r	0.0397	n/r	n/r	0.056
$^{239/240}Pu$	n/r	0.00127 Ci/L	n/r	9.85E-04 Ci/L	n/r
^{137}Cs	n/r	0.00498 Ci/L	0.474	5.86E-05 Ci/L	0.0844 Ci/L
^{90}Sr	n/r	0.00421 Ci/L	0.0132	0.014 Ci/L	0.0138 Ci/L
Total alpha	n/r	n/r	n/r	n/r	5.71E-04 Ci/L
Total volume sent to waste tanks (L)	1.74E+07	2.08E+07	n/a	n/r	n/r

Notes:

n/r = Not reported

[1]Schofield (1991), NCRW is Neutralized Cladding Removal Waste.

[2]Agnew et al. (1997a), CWZr2 is Coating Waste (REDOX), Zirconium Cladding, same as NCRW.

[3]Teats (1982), DSSF is Double-Shell Slurry Feed.

[4]These are equivalent flowsheet compositions derived from fuel cladding composition and estimates of corrosion rates (Schofield 1991).

D3.4.2 Supernatant Component Concentrations

Table D3-4 compares the sample-based concentrations for the supernatant in tank 241-AW-103, derived from the 1994 sampling event and the HDW model supernatant estimates.

Table D3-4. Sample-Based and Hanford Defined Waste Model-Based Estimates for Nonradioactive Components in the Tank 241-AW-103 Supernatant.

Analyte	Sampling[1] Inventory Estimate (μg/mL)	HDW Model[2] Estimate (μg/mL)	Analyte	Sampling[1] Inventory Estimate (μg/mL)	HDW Model[2] Estimate (μg/mL)
Al	64.6	37.2	NO_2	1,780	416
Bi	<20.1	0.206	NO_3	4,220	19,700
Ca	<20.1	294	OH	n/r	1,650
Cl	138	140	Oxalate	<435	0.00099
Cr	25.3	19.4	Pb	<20.1	0.566
F	16,800	3,540	PO_4	<497	247
Fe	<10.1	91.1	Si	249	1.97
Hg	n/r	1.56	SO_4	672	34.1
K	n/r	6,820	Sr	<2.01	0
La	<10.1	0.00119	CO_3	n/r	693
Mn	<2.01	12.1	TOC	n/r	31.2
Na	24,600	9,570	U	<100	775

Notes:
n/r = Not reported

[1]see Table B3-8
[2]Agnew et. al. (1997a), calculated from SMM using a density of 1.01.

There are major differences in the analytical-based inventories and the inventories estimated in the HDW model. The HDW model predicts that 95.1 percent of the supernatant in tank 241-AW-103 at the end of 1994 came from NCRW waste with the balance coming from miscellaneous PUREX (4.5 percent) and other wastes (0.3 percent). Analytical data for the liquid phase usually displays high precision and accuracy; therefore, the analytical values are assumed to be correct.

D3.5 ESTIMATED COMPONENT INVENTORIES

Table D3-5 compares sample-based inventories for sludge (derived from the 1997 core sampling event), supernatant (derived from the 1994 grab sample event), and total HDW model-based inventories for tank 241-AW-103.

Table D3-5. Sample-Based and Hanford Defined Waste Model-Based Inventory Estimates for Nonradiocative Components in the Tank 241-AW-103. (2 sheets)

Analyte	Solids[1] (kg)	Supernatant[2] (kg)	Total[3] (kg)	HDW model[4] (kg)
Al	12,700[5]	36.4	12,700	40
Bi	772[5]	<11.3	772	0.222
Ca	1,800[5]	<11.3	1,800	5,540
Cl	1,760	77.8	1,840	345
Cr	3,170[5]	14.2	3,180	20.9
F	115,000	9,480	124,000	142,000
Fe	1,650[5]	<5.7	1,650	28,000
K	22,900[5]	8,070	31,000	17,600
La	1,720[5]	<5.7	1,720	0.00128
Mn	540[5]	<1.13	540	13.1
Na	283,000	13,900	297,000	184,000
Ni	358[5]	<2.27	358	4.5
NO_2	28,900	1,000	29,900	1,030
NO_3	83,700	2,380	86,100	49,400
Pb	<3,600	<11.3	<3,610	0.609
PO_4	5,780[5]	33.4[3]	5,810	267
Si	5,690	140	5,830	2.12
SO_4	3,600	379	3,980	36.8
Sr	<360	<1.13	<361	0
TIC as CO_3	14,600[5]	2,650[3]	17,300	8,570
TOC	10,400	538[3]	10,900	33.5

Table D3-5. Sample-Based and Hanford Defined Waste Model-Based Inventory Estimates for Nonradiocative Components in the Tank 241-AW-103. (2 sheets)

Analyte	Solids[1] (kg)	Supernatant[2] (kg)	Total[3] (kg)	HDW model[4] (kg)
U_{total}	65,300	<56.4	65,300	13,900
Zr	221,000	<1.13	221,000	116,000
H_2O	1.08E+6	~537,000 by difference	~1.62E+6	2.16E+6
Density (kg/L)	1.490	1.02	1.35	1.17
^{90}Sr, Ci	22,900[5]	0.127[3]	22,900	10,000
^{106}Ru, Ci	45,700[5]	n/r	45,700	710
^{137}Cs, Ci	139,000[5]	11,900[3]	151,000	11,900
Total alpha, Ci	784	<0.277	784	n/r

Notes:

n/r = Not reported
HDW = Hanford Defined Waste

[1]Solids = ug/g * 1374 kL * 1490 kg/kL / 1E6 = ug/g * 2.047 = kg (see Table B3-7)
[2]Liquid = ug/mL * 564 kL / 1000 = ug/mL * 0.564 = kg (see Table B3-8)
[3]1994 grab sample data (see Table B2-60)
[4]Agnew et al. (1997a)
[5]1989 data from Table B2-61

Factors used were 1,374 kL of sludge at 1.49 specific gravity and 564 kL of supernatant at 1.02 specific gravity.

D3.6 COMMENTS ON ANALYTES

Aluminum. Although the flowsheet and the HDW model predict little Al is present in the waste, the sample data for tank 241-AW-103 indicate up to 12 metric tons of Al, the bulk being in sludge. Schofield (1991) mentions that some aluminum probably originated from aluminum nitrate used in the fuel dissolution step, and the remainder from impurities or dirt. However, Schofield wasn't aware of the aluminum-rich DSSF heel which probably accounts for most of the disparity. This fits the sample results which show the aluminum to be in the lowest sludge layers and absent in the upper volume. This is consistent with the majority of the tank containing NCRW solids over a small DSSF heel.

Zirconium. The sample result of 221 metric tons is considered accurate based on analytical consistence and charge balance. This measurement is higher than that obtained from flowsheet and fuel discharge records. However, the fuel manufacturing process is biased toward thicker cladding (Higley 1998) which would account for this difference. Therefore, the sample results are considered the most accurate. Except for the very lowest layer (which is lean), the zirconium is uniformly distributed in the sludge volume. Again, this is consistent with the majority of the tank contents consisting of NCRW solids over a small DSSF heel.

Sodium. Because of the lack of analytical data for the DSSF heel, it was not possible to determine sodium partitioning for tank 241-AW-103. The sample-based inventory will be assumed to be correct.

Nitrate/Nitrite. The analytical data show fractional molar concentration of these species in all but the bottom layer of the tank, which is multi-molar in concentration. As previously stated, this is consistent with the majority of the tank contents consisting of NCRW solids over a small DSSF heel.

Chromium. Because the data on the DSSF heel do not include chromium as an analyte, a proper reconciliation could not be done. The sample-based inventory will be assumed to be correct.

Fluoride. For the sludge, the sample-based inventory agrees more closely with previous samples than the HDW model estimate. The sample-based inventory will be assumed to be correct.

Mercury. The best-basis inventory value for tank 241-AW-103 should be zero because no mercury bearing waste was disposed or transferred to the tank. The change package dated February 26, 1998, describes the details (Simpson 1998).

Total Hydroxide. Once the best-basis inventories were determined, the hydroxide inventory was calculated by performing a charge balance with the valence of other analytes. This charge balance approach is consistent with that used by Agnew et al. (1997a).

D4.0 DEFINE THE BEST-BASIS AND ESTABLISH COMPONENT INVENTORIES

Information about chemical, radiological, and/or physical properties is used to perform safety analyses, engineering evaluations, and risk assessment associated with waste management activities, as well as regulatory issues. These activities include overseeing tank farm operations and identifying, monitoring, and resolving safety issues associated with these operations and with the tank wastes. Disposal activities involve designing equipment, processes and facilities for retrieving wastes and processing them into a form that is suitable for long-term storage.

Chemical and radiological inventory information are generally derived using three approaches: 1) component inventories are estimated using the results of sample analyses; 2) component inventories are predicted using the HDW model based on process knowledge and historical information; or 3) a tank-specific process estimate is made based on process flowsheets, reactor fuel data, essential material usage, and other operating data.

An effort is underway to provide waste inventory estimates that will serve as standard characterization source terms for the waste management activities (Hodgson and LeClair 1996). As part of this effort, an evaluation of chemical information for tank 241-AW-103 was performed, including the following information:

- Data from samples from tank 241-AW-103 collected in 1997
- Supernatant data from grab samples collected in 1994
- Flow sheet information for the NCRW waste (Kupfer et al. 1997)
- Inventory estimates generated by the HDW model.

Best-basis tank inventory values are derived for 46 key radionuclides (as defined in Section 3.1 of Kupfer et al. 1997), all decayed to a common report date of January 1, 1994. Often, waste sample analyses have only reported ^{90}Sr, ^{137}Cs, $^{239/240}$Pu, and total uranium (or total beta and total alpha) while other key radionuclides such as ^{60}Co, 99Tc, ^{129}I, ^{154}Eu, ^{155}Eu, and ^{241}Am have been infrequently reported. For this reason, it has been necessary to derive most of the 46 key radionuclides by computer models. These models estimate radionuclide activity in batches of reactor fuel, account for the split of radionuclides to various separations plant waste streams, and track their movement with tank waste transactions. These computer models are described in Kupfer et al. 1997, Section 6.1, and in Watrous and Wootan 1997. Model generated values for radionuclides in any of 177 tanks are reported in Agnew et al. 1997a. The best-basis value for any one analyte may be a model result or a sample or engineering assessment-based result, if available.

Best-basis inventory estimates for tank 241-AW-103 are presented in Tables D4-1 through D4-2. The inventory values reported in Tables D4-1 through D4-2 are subject to change. Refer to the Tank Characterization Database for the most current inventory values.

Table D4-1. Best-Basis Inventory Estimates for Nonradioactive Components in Tank 241-AW-103 (Effective March 31, 1998).

Analyte	Total Inventory (kg)	Basis (S, M, E, or C)[1]	Comment
Al	12,700	S/E	1989 sludge, 1997 supernatant data
Bi	772	S/E	1989 data, sludge only
Ca	1,800	S/E	1989 data, sludge only
Cl	1,840	S	
TIC as CO_3	17,300	S	
Cr	3,180	S/E	1989 sludge, 1997 supernatant data
F	124,000	S	
Fe	1,650	S/E	1989 data, sludge only
Hg	0	E	Simpson (1998)
K	31,000	S/E	1989 sludge, 1997 supernatant data
La	1,720	S/E	1989 data, sludge only
Mn	540	S/E	1989 data, sludge only
Na	2.97E+05	S	
Ni	358	S/E	1989 data, sludge only
NO_2	29,900	S	
NO_3	86,100	S	
OH_{TOTAL}	2.86E+05	C	Based on charge balance
Pb	3,610	S	Upper limit
PO_4	5,810	S/E	1989 ICP sludge, 1994 supernatant data
Si	5,830	S	
SO_4	3,980	S	
Sr	361	E	Upper limit
TOC	10,900	S	
U_{TOTAL}	65,300	S	
Zr	2.21E+05	S	

Note:
[1]S = sample-based, M = HDW model-based (Agnew et al. 1997a), E = engineering assessment-based, and C = calculated by charge balance; includes oxides as hydroxides, not including CO_3, NO_2, NO_3, PO_4, SO_4, and SiO_3.

Table D4-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-AW-103 Decayed to January 1, 1994 (Effective March 31, 1998). (2 sheets)

Analyte	Total inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{3}H	41.3	M	
^{14}C	0.532	M	
^{59}Ni	0.196	M	
^{60}Co	7.84	M	
^{63}Ni	22.7	M	
^{79}Se	0.0665	M	
^{90}Sr	19,000	S	1989 sludge, 1994 supernatant data
^{90}Y	19,000	S	Based on ^{90}Sr activity
^{93}Zr	0.321	M	
^{93m}Nb	0.140	M	
^{99}Tc	2.31	M	
^{106}Ru	743	S	1989 data, sludge only
^{113m}Cd	3.37	M	
^{125}Sb	189	M	
^{126}Sn	0.105	M	
^{129}I	0.00462	M	
^{134}Cs	83.9	M	
^{137}Cs	1.51E+05	S	1989 sludge, 1994 supernatant data
^{137m}Ba	1.43E+05	S	Based on 0.946 of ^{137}Cs activity
^{151}Sm	230	M	
^{152}Eu	1.53	M	
^{154}Eu	58.9	M	
^{155}Eu	277	M	
^{226}Ra	6.53E-07	M	
^{227}Ac	3.88E-06	M	
^{228}Ra	3.32E-04	M	
^{229}Th	7.73E-06	M	
^{231}Pa	2.07E-05	M	
^{232}Th	2.81E-05	M	
^{232}U	0.0133	S/E	Based on ICP U sample result ratioed to HDW estimates for U isotopes.

Table D4-2. Best-Basis Inventory Estimates for Radioactive Components in Tank 241-AW-103 Decayed to January 1, 1994 (Effective March 31, 1998). (2 sheets)

Analyte	Total inventory (Ci)	Basis (S, M, or E)[1]	Comment
^{233}U	0.0240	S/E	Based on ICP U sample result ratioed to HDW estimates for U isotopes.
^{234}U	31.7	S/E	Based on ICP U sample result ratioed to HDW estimates for U isotopes.
^{235}U	1.20	S/E	Based on ICP U sample result ratioed to HDW estimates for U isotopes.
^{236}U	2.61	S/E	Based on ICP U sample result ratioed to HDW estimates for U isotopes.
^{237}Np	0.0317	M	
^{238}Pu	61.6	S/M	Based on total alpha sample result ratioed to HDW estimates for Pu and Am
^{238}U	21.8	S/E	Based on ICP U sample result ratioed to HDW estimates for U isotopes.
^{239}Pu	499	S/M	Based on total alpha sample result ratioed to HDW estimates for Pu and Am
^{240}Pu	152	S/M	Based on total alpha sample result ratioed to HDW estimates for Pu and Am
^{241}Am	14.4	S/M	Based on total alpha sample result ratioed to HDW estimates for Pu and Am
^{241}Pu	6,290	S/M	Based on total alpha sample result ratioed to HDW estimates for Pu and Am
^{242}Cm	0.0497	S/M	Based on total alpha sample result ratioed to HDW estimates for Pu and Am
^{242}Pu	0.0235	S/M	Based on total alpha sample result ratioed to HDW estimates for Pu and Am
^{243}Am	0.00304	S/M	Based on total alpha sample result ratioed to HDW estimates for Pu and Am
^{243}Cm	0.00832	S/M	Based on total alpha sample result ratioed to HDW estimates for Pu and Am
^{244}Cm	0.0553	S/M	Based on total alpha sample result ratioed to HDW estimates for Pu and Am

Note:

[1]S = sample-based (see Appendix B), M = HDW model-based (Agnew et al.(1997a), and E = engineering assessment-based.

D5.0 APPENDIX D REFERENCES

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APPENDIX E

BIBLIOGRAPHY FOR TANK 241-AW-103

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APPENDIX E

BIBLIOGRAPHY FOR TANK 241-AW-103

Appendix E is a bibliography that supports the characterization of tank 241-AW-103. This bibliography represents an in-depth literature search of all known information sources that provide sampling, analysis, surveillance, modeling information, and processing occurrences associated with tank 241-AW-103 and its respective waste types.

The references in this bibliography are separated into three categories containing references broken down into subgroups. These categories and their subgroups are listed below.

I. NON-ANALYTICAL DATA

- Ia. Models/Waste Type Inventories/Campaign Information
- Ib. Fill History/Waste Transfer Records
- Ic. Surveillance/Tank Configuration
- Id. Sample Planning/Tank Prioritization
- Ie. Data Quality Objectives/Customers of Characterization Data

II. ANALYTICAL DATA - SAMPLING OF TANK WASTE AND WASTE TYPES

- IIa. Sampling of Tank 241-AW-103
- IIb. Sampling of 242-A Evaporator Streams
- IIc. Sampling of PUREX Waste Streams

III. COMBINED ANALYTICAL/NON-ANALYTICAL DATA

- IIIa. Inventories using both Campaign and Analytical Information
- IIIb. Compendium of Existing Physical and Chemical Documented Data Sources

The bibliography is broken down into the appropriate sections of material with an annotation at the end of each reference describing the information source. Most information listed below is available in the Lockheed Martin Hanford Corporation Tank Characterization and Safety Resource Center.

I. NON-ANALYTICAL DATA

Ia. Models/Waste Type Inventories/Campaign Information

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- Contains single-shell tank fill history and primary campaign and waste information to 1981.

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Ib. Fill History/Waste Transfer Records

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WHC, 1989, *Sample Status Report for R 5759 Received 9/18/89*, (Data sheet, October 17), Westinghouse Hanford Company, Richland, Washington.

- Contains sample analysis results for tank 241-AW-103.

WHC, 1989, *Sample Status Report for R 5756, Received 9/18/89*, (Data sheet, October 18), Westinghouse Hanford Company, Richland, Washington.

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WHC, 1990, *Sample Status Report for R 6297, Received 1/29/90*, (Data sheet, March 6), Westinghouse Hanford Company, Richland, Washington.

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WHC, 1990, *Sample Status Report for R 6298, Received 1/29/90*, (Data sheet, March 6), Westinghouse Hanford Company, Richland, Washington.

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WHC, 1994, *Sample Status Report for R 6491, Received 9/30/94*, (Data sheet, October 11), Westinghouse Hanford Company, Richland, Washington.

- Contains sample analysis results for tank 241-AW-103.

WHC, 1994, *Sample Status Report for R 6492, Received 9/30/94*, (Data sheet, October 11), Westinghouse Hanford Company, Richland, Washington.

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WHC, 1994, *Sample Status Report for R 6493, Received 9/30/94*, (Data sheet, October 11), Westinghouse Hanford Company, Richland, Washington.

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WHC, 1994, *Sample Status Report for R 6494, Received 9/30/94*, (Data sheet, October 11), Westinghouse Hanford Company, Richland, Washington.

- Contains sample analysis results for tank 241-AW-103.

IIb. Sampling 242 A-Evaporator Waste Streams (1976 to 1980)

Kimura, R. T., 1986, *242-A Evaporator/Crystallizer FY 1986 Campaign 86-1 Post Run Document*, SD-WM-PE-026, Rev.0, Rockwell Hanford Operations, Richland, Washington.

- Contains sample analysis results for feed tanks to the 242-A Evaporator.

Kimura, R. T., 1986, *242-A Evaporator/Crystallizer FY 1986 Campaign Run 86-3 Post Run Document*, SD-WM-PE-029, Rev.0, Rockwell Hanford Operations, Richland, Washington.

- Contains sample analysis results for feed tanks to the 242-A Evaporator.

Mauss, B. M., 1985, *242-A Evaporator Run 85-1: Laboratory Results and Chemical Analysis* (internal letter 65453-88-010 to N. L. Pontious, January 16), Rockwell Hanford Operations, Richland, Washington.

- Contains historical sample analysis results of feed to the 242-A Evaporator.

Mauss, B. M., and M. T. Jansky, 1985, *Laboratory Boildowns in Support of Evaporator Run 84-5*, (internal letter 65453-85-013 to E. G. Gratny and N. L. Pontious, January 18), Rockwell Hanford Operations, Richland, Washington.

- Contains historical sample analysis results for mixed 241-AW-102 and 241-AW-103 tank samples.

Teats, M. C., 1982, *242-A Evaporator Campaign 80-8 Post Run Document*, WHC-SD-WM-PE-004, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Contains analytical results for the evaporator campaign.

IIc. Sampling of PUREX Waste Streams

Barker, S. A., 1989, *Preliminary Estimate of Dissolution Performed for Neutralized Cladding Removal Waste*, (internal letter to J. N. Appel, September 20), Westinghouse Hanford Company, Richland, Washington.

- Contains estimated of neutralized cladding removal waste composition.

Hanson, M. S., 1986, *Letter Report Transmittal: Characterization of Actual Zirflex Decladding Sludge*, (external letter #30874 to R. D. Wojtasek, RHO, June 6), Pacific Northwest Laboratory, Richland, Washington.

- Contains estimate of NCRW composition using sample from tank 241-AW-105.

Lowe, S. S. 1991, *Preliminary Material Balances for Pretreatment of NCAW, NCRW, PFP, and CC Wastes*, WHC-SD-WM-TI-492, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Contains estimate of neutralized cladding removal waste based on sample analysis results from tank 241-AW-103

Reynolds, D. A., 1989, *Washing Fluoride from Neutralized Cladding Removal Waste*, (internal memorandum 13314-89-047 to D. M. Nguyen, May 25), Westinghouse Hanford Company, Richland, Washington.

- Contains simulated fluoride washing study using sample analysis results from tank 241-AW-103 as composition of neutralized cladding removal waste samples.

Sasaki, L. M., 1985, *NCRW Sludge Radionuclide Content*, (DSI to L. Vanselow, August 26), Rockwell Hanford Operations, Richland, Washington.

- Contains estimate of NCRW composition.

Sasaki, L. M., 1997, *Tank Characterization Report for Double-Shell Tank 241-AW-105*, WHC-SD-WM-ER-364, Rev. 1-A, Lockheed Martin Hanford Corporation, Richland, Washington.

- Contains sample analysis results of NCRW type.

Swanson, J. L., 1991, *Initial Studies of Pretreatment Methods for Neutralized Cladding Removal Waste (NCRW) Sludge*, PNL-7716, Rev. 0, Pacific Northwest Laboratory, Richland, Washington.

- Summarizes several years of laboratory work to separate NCRW sludge into TRU and low-level streams for disposal purposes.

III. COMBINED ANALYTICAL/NON-ANALYTICAL DATA

IIIa. Inventories from Campaign and Analytical Information

Agnew, S. F., J. Boyer, R. A. Corbin, T. B. Duran, J. R. Fitzpatrick, K. A. Jurgensen, T. P. Ortiz, and B. L. Young, 1997, *Hanford Tank Chemical and Radionuclide Inventories: HDW Model Rev. 4*, LA-UR-96-3860, Rev. 0, Los Alamos National Laboratory, Los Alamos, New Mexico.

- Contains waste type summaries and primary chemical compound/ analyte and radionuclide estimates for sludge, supernatant, and solids.

Brevick, C. H., J. L. Stroup, and J. W. Funk, 1997, *Historical Tank Content Estimate for the Southeast Quadrant of the Hanford 200 Areas*, WHC-SD-WM-ER-350, Rev. 1, Fluor Daniel Northwest, Inc. for Fluor Daniel Hanford, Inc., Richland, Washington.

- Contains summary information from the supporting document as well as in-tank photograph collages and the solid composite inventory estimates from Rev. 0 and Rev. 0A.

Pajunen, A. L,. and R. A. Watrous, 1994, *Plutonium and Americium Inventory Estimates in Selected Double-Shell Tank Waste Types*, (internal memorandum to D. J. Washenfelder, September 20), Westinghouse Hanford Company, Richland, Washington.

- Contains plutonium and americium estimates for neutralized current acid waste and neutralized cladding removal waste.

Schmittroth, F. A., 1995, *Inventories for Low-Level Tank Waste*, WHC-SD-WM-RPT-164, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Contains tank inventory information.

IIIb. Compendium of Data from Other Physical and Chemical Sources

Brevick, C. H., J. L. Stroup, and J. W. Funk, 1997, *Supporting Document for the Historical Tank Content Estimate for AW-Tank Farm,* WHC-SD-WM-ER-316, Rev. 1, Fluor Daniel Northwest, Inc. for Fluor Daniel Hanford, Inc., Richland, Washington.

- Contains historical data such as waste history, temperature profiles, psychometric data, tank integrity, inventory estimates, and tank-level history

Brevick, C. H., L. A. Gaddis, and E. D. Johnson, 1995, *Tank Waste Source Term Inventory Validation, Vol I & II.*, WHC-SD-WM-ER-400, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Contains a quick reference to sampling information in spreadsheet or graphical form for 23 chemicals and 11 radionuclides for all tanks.

De Lorenzo, D. S., A. T. DiCenso, D. B. Hiller, K. W. Johnson, J. H. Rutherford, B. C. Simpson, and D. J. Smith, 1994, *Tank Characterization Reference Guide,* WHC-SD-WM-TI-648, Rev. 0A, Westinghouse Hanford Company, Richland, Washington.

- Document contains general requirements for sampling and analysis of single-shell and double-shell tanks.

DiCenso, A. T., L. C. Amato, J. D. Franklin, R. W. Lambie, R. H. Stephens, and B. C. Simpson, 1994, *Tank Characterization Report for Double-Shell Tank 241-AW-105*, WHC-SD-WM-ER-364, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Contains sample analysis results of neutralized cladding removal waste.

Hanlon, B. M., 1998, *Waste Tank Summary Report for Month Ending February 28, 1998*, WHC-EP-0182-119, Lockheed Martin Hanford Corp. for Fluor Daniel Hanford, Inc., Richland, Washington.

- Contains a monthly summary of the following: fill volumes, Watch List tanks, occurrences, integrity information, equipment readings, equipment status, tank location, and other tank information.

Hanson, M. S., 1986, *Letter Report Transmittal: Characterization of Actual Zirflex Decladding Sludge*, (external letter 30874 to R. D. Wojtasek, June 6), Pacific Northwest Laboratory, Richland, Washington.

- Contains an estimate of neutralized cladding removal waste composition using a sample from tank 241-AW-105.

Husa, E. I., 1993, *Hanford Site Waste Storage Tank Information Notebook*, WHC-EP-0625, Westinghouse Hanford Company, Richland, Washington.

- Contains in-tank photographs and summaries on the tank description, leak detection system, and tank status.

Husa, E. I., 1995, *Hanford Waste Tank Preliminary Dryness Evaluation*, WHC-SD-WM-TI-703, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

- Assesses relative dryness between tanks.

Peters, B. B., 1998, *Tank 103-AW Sampling Options*, (internal letter 1221-PCL88-116 to D. W. Bergmann, April 28), Westinghouse Hanford Company, Richland, Washington.

- Contains information on expected waste to be obtained from core sampling.

Sasaki, L. M., 1985, *NCRW Sludge Radionuclide Content*, (DSI to L. Vanselow, August 26), Rockwell Hanford Operations, Richland, Washington.

- Contains estimate of NCRW composition.

Shelton, L. W., 1996, *Chemical and Radionuclide Inventory for Single- and Double-Shell Tanks*, (internal memorandum 74A20-96-30 to D. J. Washenfelder, February 28), Westinghouse Hanford Company, Richland, Washington.

- Contains a tank inventory estimate based on analytical information.

Strode, J. N., and V. C. Boyles, 1997, *Operation Waste Volume Projection*, HNF-SD-WM-ER-029, Rev. 23, Lockheed Martin Hanford Corp. for Fluor Daniel Hanford, Inc., Richland, Washington.

- Contains projection of contents to be transferred between double-shell tanks.

Van Vleet, R. J., 1993, *Radionuclide and Chemical Inventories for the Double-Shell Tanks*, WHC-SD-WM-TI-543, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

- Contains tank inventory information.

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